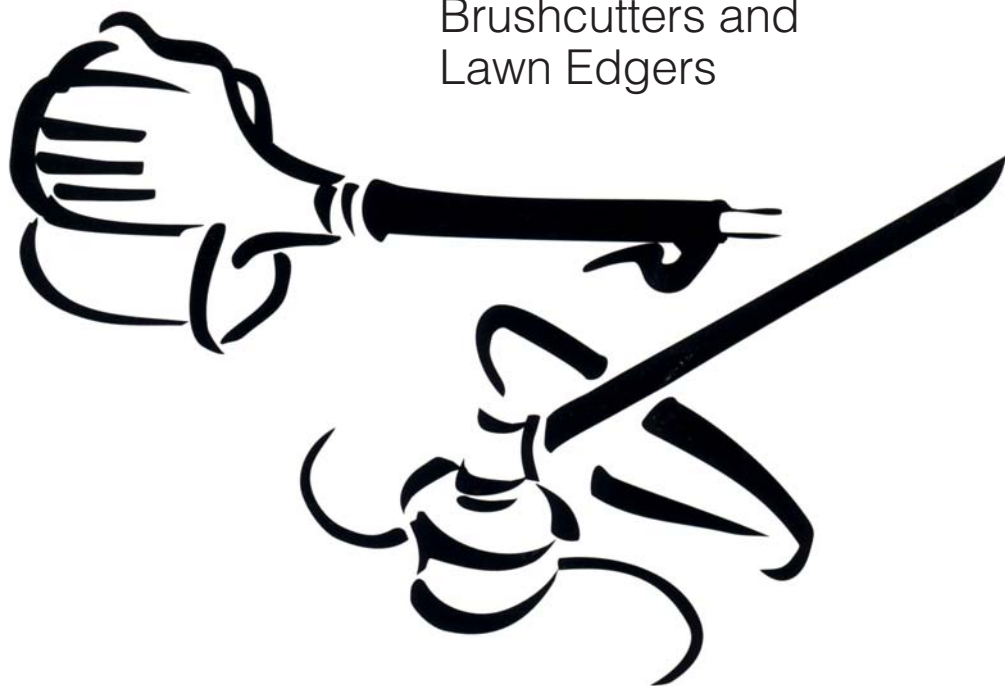


## SERVICE MANUAL

Shindaiwa Grass Trimmers,  
Brushcutters and  
Lawn Edgers



**shindaiwa**

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# Service Manual

## Shindaiwa Grass Trimmers, Brushcutters and Lawn Edgers

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# Attention Statements

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Throughout this manual are special “attention” statements surrounded by boxes and preceded by the triangular Attention Symbol:



## **WARNING!**

A statement preceded by the word “WARNING” contains information that should be acted upon to prevent serious bodily injury.



## **CAUTION!**

A statement preceded by the word “CAUTION” contains information that should be acted upon to avoid damaging your machine.

Additional attention statements that are not preceded by the Attention Symbol are:

## **IMPORTANT!**

A statement preceded by “IMPORTANT” is one that possesses special significance.

## **NOTE:**

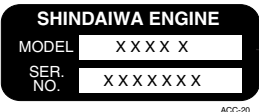
A statement preceded by “NOTE” contains information that is handy to know and may make your job easier.

☞ *A statement preceded by a pointing finger is a tip, suggestion or other “trick of the trade” that just might ease your task.*

# Model Designation and Identification Section 1

## Curved-shaft Grass Trimmers

Typical identification  
placard locations



Located on the  
engine

Typical  
nameplate  
location



ACC-22

*F-18 Grass Trimmer*

*F-230 Grass Trimmer*

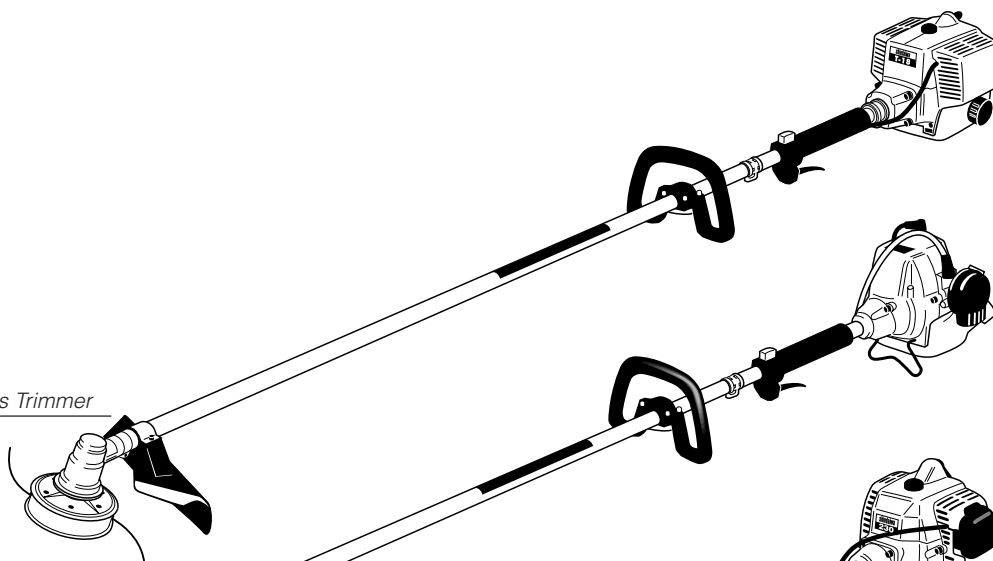
*F-20 Grass Trimmer*

*F-21 Grass Trimmer*

# Section 1 Model Designation and Identification

## Straight-shaft Grass Trimmers

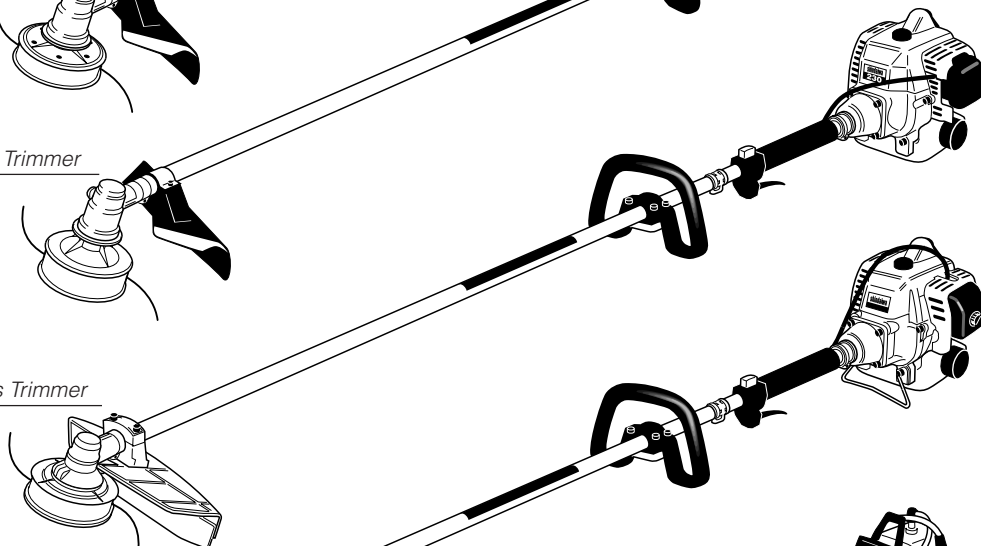
*T-18 Grass Trimmer*



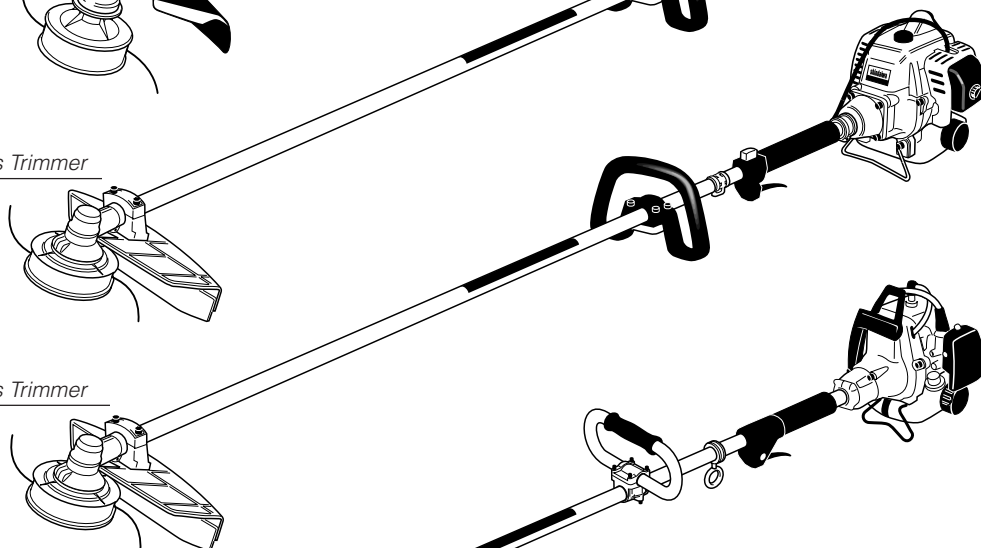
*T-20 Grass Trimmer*



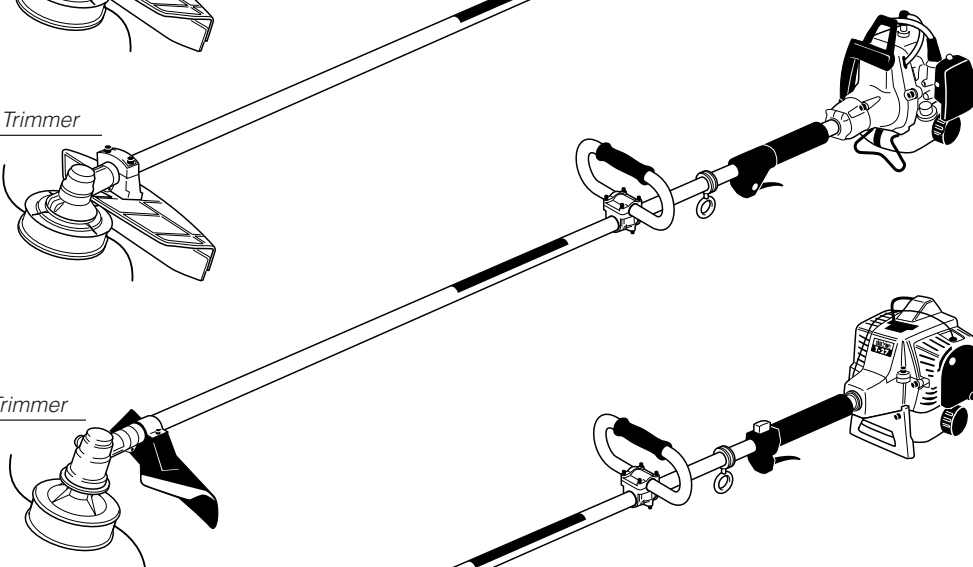
*T-230 Grass Trimmer*



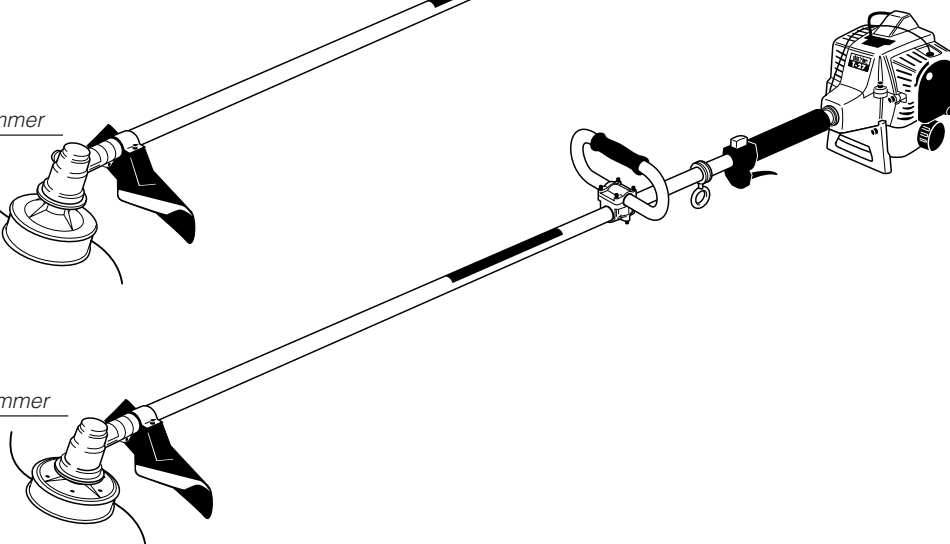
*T-250 Grass Trimmer*



*T-25 Grass Trimmer*

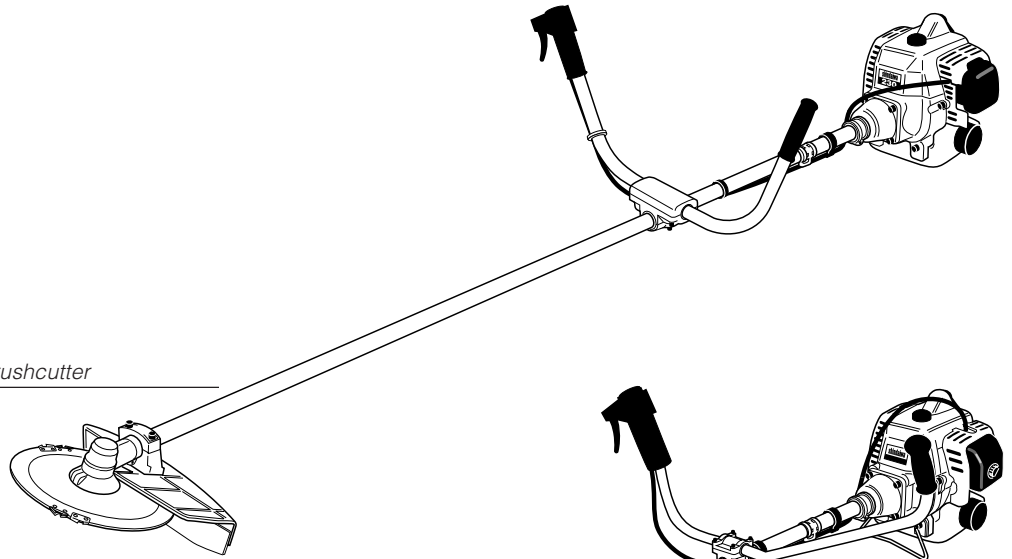


*T-27 Grass Trimmer*

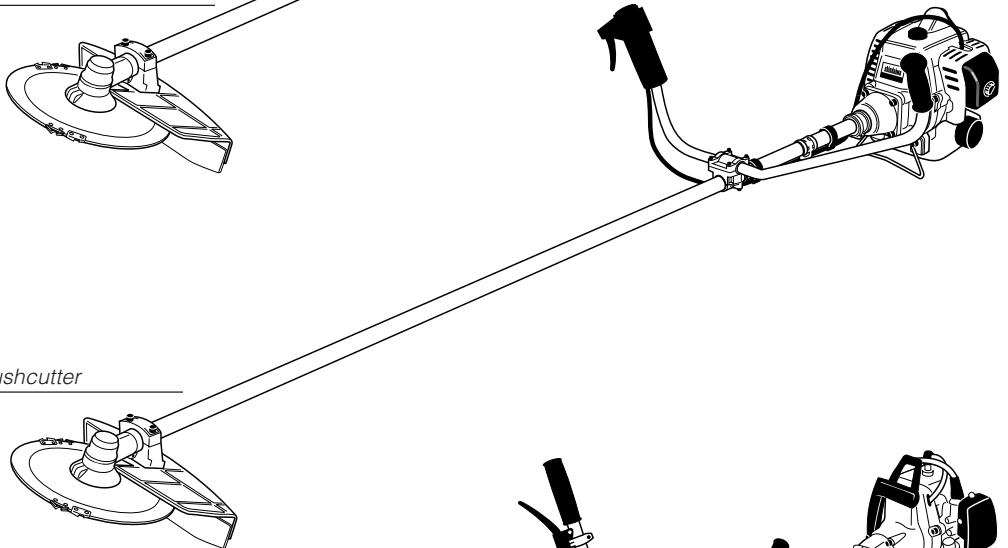


## Brushcutters

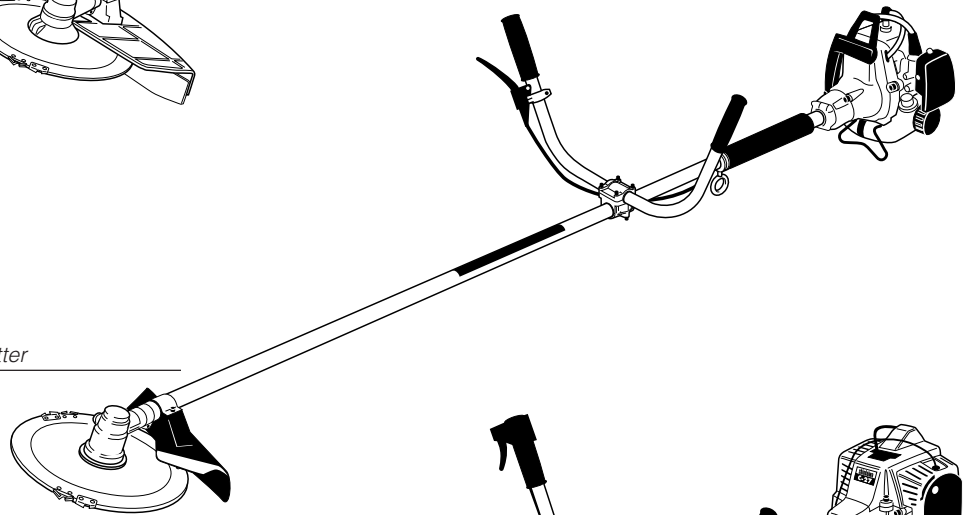
*C-230 Brushcutter*



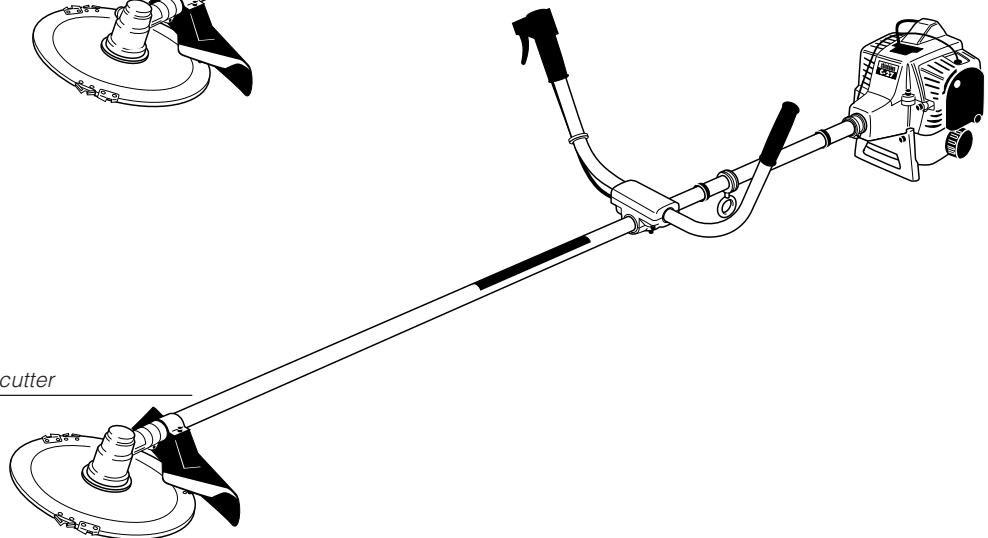
*C-250 Brushcutter*



*C-25 Brushcutter*



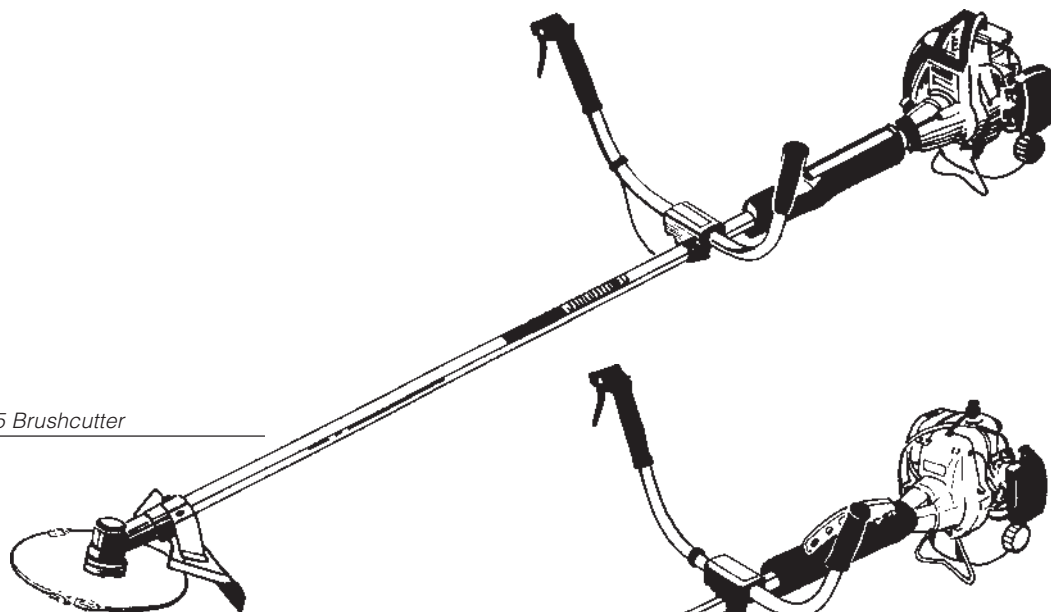
*C-27 Brushcutter*



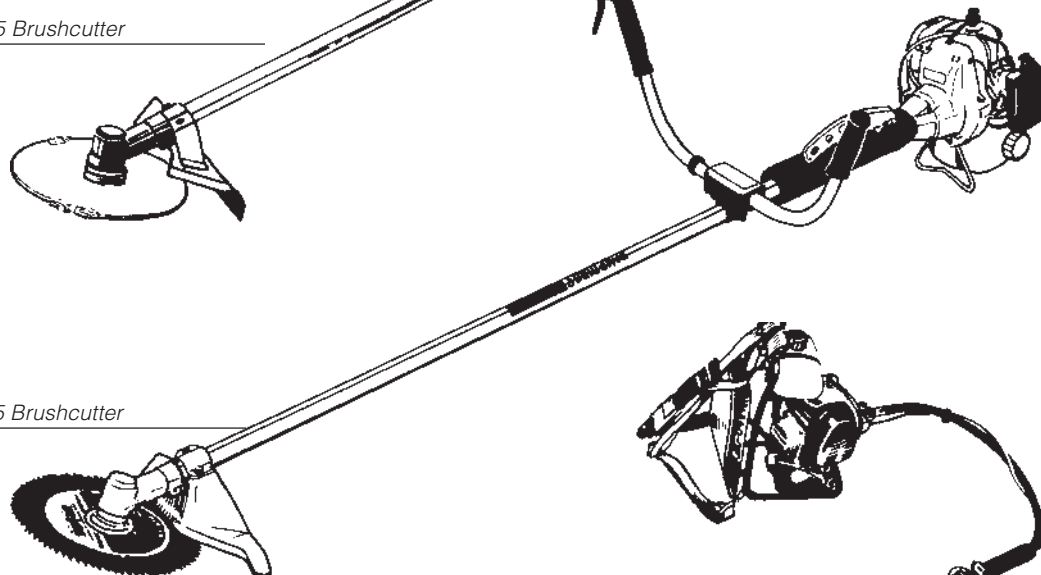
# Section 1 Model Designation and Identification

## Brushcutters

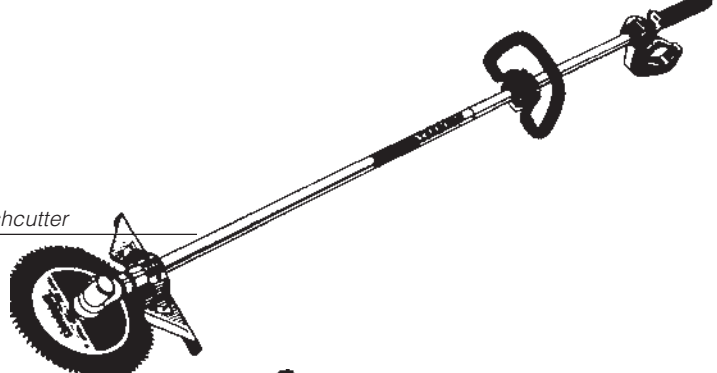
*C-35 Brushcutter*



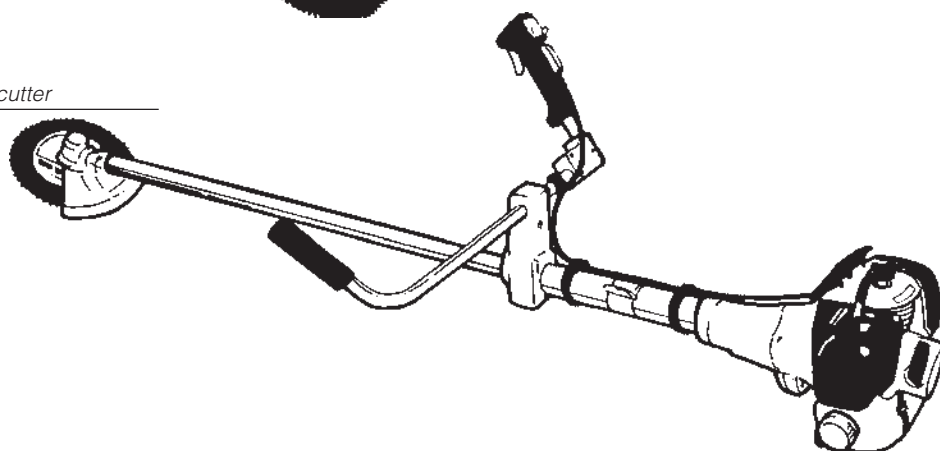
*B-45 Brushcutter*



*BP-35 Brushcutter*

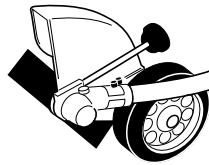


*RC-45 Brushcutter*

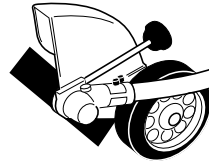


## Lawn Edgers

*LE-230 Lawn Edger*



*LE-250 Lawn Edger*





# Section 2 Troubleshooting The 2-Stroke Cycle Engine

## Theory of Operation

*A two-stroke cycle or "two-cycle" engine produces one power stroke for every revolution of its crankshaft. Intake and compression occurs during the piston's "up" stroke; power and exhaust occurs during the "down" stroke.*

*Six distinct processes occur during every revolution of the crankshaft. Since a loss or weakness of even one of these processes will affect the other five, an understanding of them will go a long way toward accurately diagnosing problems during troubleshooting.*

### 1. Intake

When the piston moves up toward the cylinder head, a vacuum is created in the crankcase. As the piston uncovers the intake port, the vacuum draws a fresh charge fuel-air mixture into the crankcase.

The fuel-air mixture accomplishes two functions before it is moved to the combustion chamber during the *transfer* process:

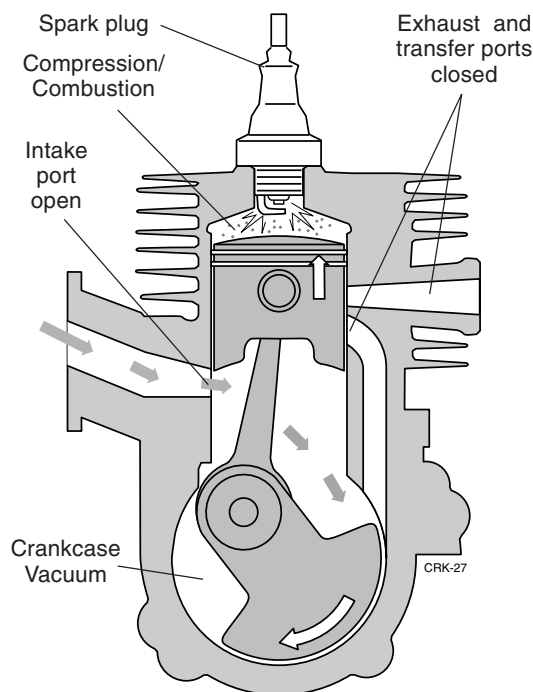
- Oil in the fuel-air mix coats all internal parts including cylinder walls, crankshaft, and bearings.
- In addition, the atomized fuel mixture absorbs heat as it enters the crankcase, lowering the engine's operating temperatures.

### 2. Compression

The piston continues to move upward, closing off all ports above the piston crown. The air-fuel mixture introduced during the *previous* revolution's transfer cycle is now trapped in the combustion chamber and compressed.

### 3. Ignition

As the piston approaches the cylinder head, the spark plug fires and ignites the fuel-air mixture. To compensate for increases in engine rpm, the spark timing is advanced electronically.



*Figure 2.1 Crankcase vacuum is created during the compression stroke. As the piston uncovers the intake port, a fresh fuel-air mixture is drawn into the crankcase. When the spark plug fires, the compressed mixture above the piston ignites and begins to expand.*

### 4. Power (combustion)

The fuel-air mixture expands rapidly, forcing the piston down the cylinder. Piston movement is transferred to the crankshaft through the connecting rod, turning the crankshaft.

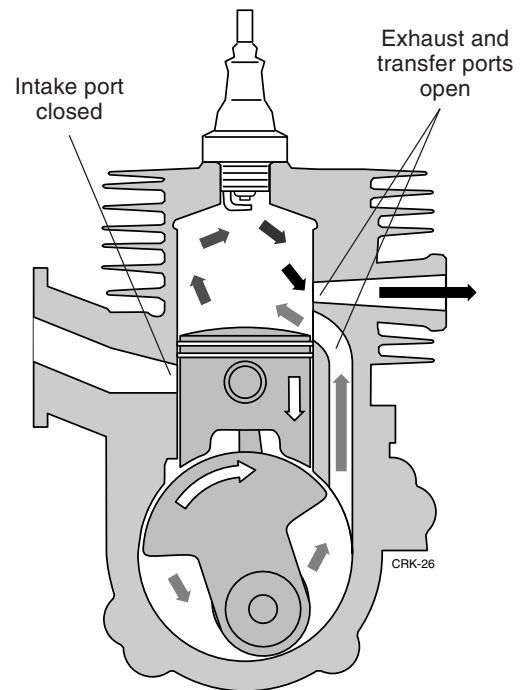
### 5. Exhaust

Expanding gasses continue to force the piston downward. As the piston exposes the exhaust port, most of the spent combustion gasses are expelled through the port and out the muffler.

### 6. Transfer

The piston's downward movement covers the intake port and simultaneously opens the transfer port. That allows the compressed fuel-air mixture from Step 1 to enter the cylinder.

As the fresh fuel-air mixture enters the cylinder, it also helps push or *scavenge* remaining exhaust gasses out through the exhaust port.



*Figure 2.2 The burning mixture expands, forcing the piston down and rotating the crankshaft. Continued piston movement compresses the fresh mixture in the crankcase. As the piston exposes the transfer port, crankcase pressure forces fresh mixture into the combustion chamber and helps push the remaining exhaust gasses through the exhaust port.*

**Factors That Affect Durability**

All Shindaiwa products are powered by high performance engines that produce the most horsepower from the lightest possible design.

Two factors are critical to the service life and durability of any high performance engine:

**1. Lubrication**

Proper lubrication is essential for reducing friction between an engine's moving parts.

By reducing friction, lubrication also helps reduce the heat developed during engine operation.

Since a 2-cycle engine doesn't have a reservoir of oil in its crankcase, a steady supply of high-quality lubricant must enter the engine with the fuel mixture.

Refer to the Fuel and Oil Section of the Appendix for specific fuel/oil information.

**2. Cooling**

Cooling any high performance engine is a complex task. To remove the heat generated from both friction and the combustion process, Shindaiwa engines rely on:

- Lubricating Oil
- Air-Fuel Mixture
- Cylinder Fin Design
- Flywheel Fan



**CAUTION!**

Proper lubrication and cooling are essential to both the performance and service life of any two-cycle engine! Even a partial failure in one or both of these areas can lead to engine seizure!

## Troubleshooting Guide

### THE ENGINE DOES NOT START

What To Check	Possible Cause	Remedy
Does the engine crank OK? <b>YES</b>	<b>NO</b> Faulty recoil starter. Fluid in the crankcase. Internal damage.	Refer to the Recoil Starter Section. Refer to the Carburetor Section. Refer to the Engine Crankcase and also the Cylinder and Piston Sections.
Is there good compression? <b>YES</b>	<b>NO</b> Loose spark plug. Excess wear on cylinder, piston, rings.	Tighten and re-test. Refer to the Cylinders and Piston Section.
Is the fuel fresh and of the proper grade and mixture? <b>YES</b>	<b>NO</b> Fuel is out-dated: may be stale or varnished.	Re-fill with fresh fuel of the correct mixture (Shindaiwa Premium 2-cycle Engine Oil and gasoline, 40 : 1 ratio.) Refer to the Appendix, Section 13
Is fuel visible and moving in the return line during priming? <b>YES</b>	<b>NO</b> Check for clogged fuel filter and/or vent. Clean as required.	Re-start. Refer to the Carburetor Section.
Is there spark at the spark plug wire terminal? <b>YES</b>	<b>NO</b> The ignition switch "OFF". Faulty ignition ground. Faulty coil and/or transistor unit.	Move switch to "ON" and re-start. Refer to the Ignition Section. Refer to the Ignition Section.
Is the spark plug firing properly? <b>NO</b>	If the plug is wet, excess fuel may be in the cylinder.  The plug may be fouled or improperly gapped.  The plug may be damaged internally or the wrong type.	Crank the engine with the plug removed, replace the plug, and re-start.  Clean and re-gap the plug to 0.24 inch (0.6 mm). Re-start.  Replace the plug with a Champion CJ8. Re-start.

Troubleshooting  
Guide

TROUBLESHOOTING

LOW POWER OUTPUT

Symptom	Possible Cause	Remedy
<div>Is the engine overheating?</div>	Operator is overworking the machine.	Adjust trimmer line. Cut at a slower rate.
	Carburetor mixture is too lean.	Adjust the carburetor. For proper procedures, refer to the Carburetor and Specifications Sections.
	Improper gas/oil ratio.	Re-fill with fresh fuel of the correct mixture (Shindaiwa Premium 2-cycle Engine Oil and gasoline—40 : 1 ratio; other brands—25 : 1 ratio).
	Fan, fan cover, cylinder fins dirty or damaged.	Clean, repair or replace as necessary.
	Carbon deposits on the piston.	Decarbonize. Refer to the Piston and Cylinder Section.
<div> The engine runs rough at all speeds.   The exhaust is black.   There is unburned fuel at the exhaust. </div>	Clogged air filter.	Service the filter.
	Loose or damaged spark plug.	Tighten or replace.
	Air leakage or debris in the fuel system	Repair or replace filter and/or fuel line. Refer to the Carburetor Section (pressure test).
	Water in the fuel.	Replace the fuel.
	Piston seizure.	Refer to the Cylinder and Piston Section.
	Faulty carburetor and/or diaphragm.	Refer to the Carburetor Section.
<div>The engine knocks while running.</div>	Overheating condition.	Refer to the Lubricants Section (fuel mixture); Carb. Section (carb settings; spark plug).
	Improper fuel.	Check fuel octane rating; check for presence of alcohol in the fuel. Refer to the Fuel and Oil Section of the Appendix. Refuel as necessary.
	Carbon deposits in the combustion chamber.	Decarbonize (refer to the Piston and Cylinder Section).

## Troubleshooting Guide

ADDITIONAL PROBLEMS		
Symptom	Possible Cause	Remedy
Poor acceleration.	Clogged air filter.	Clean the air filter. Refer to the Carburetor Section.
	Muffler is clogged.	Decarbonize. Refer to the Muffler Section.
	Clogged fuel filter.	Replace the fuel filter (Carburetor Section).
	Carburetor mixture is incorrect	Adjust carburetor (Carburetor Section).
	Idle speed set too low.	Adjust. Refer to the Specifications Section.
Engine stops abruptly.	Switch is turned off.	Reset the switch and re-start.
	Fuel tank empty.	Refuel.
	Clogged fuel strainer.	Replace strainer.
	Water in the fuel.	Drain; replace with clean fuel.
	Shorted spark plug or loose terminal.	Clean or replace spark plug, tighten the terminal.
	Ignition failure.	Refer to the Ignition Section.
Engine difficult to shut off.	Piston seizure.	Refer to the Cylinder and Piston Section.
	Ground (stop) wire is disconnected, or switch is defective.	Test and replace as required (Ignition Section).
	Overheating due to incorrect spark plug.	Correct plug: Champion CJ8 (Ignition Section).
Cutting attachment rotates at engine idle.	Overheated engine.	Idle engine until cool. Find cause of overheat!
	Engine idle speed is set too high.	Set idle. See The Specification Section.
	Broken clutch spring or worn clutch spring boss.	Replace spring/shoes as required, check idle speed (Clutch Section).
Excessive vibration	Loose attachment holder.	Inspect and re-tighten holders securely.
	Warped or damaged attachment.	Inspect and replace attachment as required.
	Loose gearcase.	Tighten gearcase securely. See the Gearcase and Mainshaft Sections.
	Bent main shaft/worn or damaged bushings.	Inspect and replace as necessary. See the Gearcase and Mainshaft Sections.

## Diagnosing Engine Seizure

Whenever there is metal-to-metal contact between internal moving parts, the engine can seize. Most engine seizure can be traced to at least one of the following:

### Lubrication (Figure 2.3)

- **Lack of oil.** Insufficient or poorly mixed oil ratio. Shindaiwa machines are designed to use Shindaiwa Premium 2-cycle Engine Oil at a ratio of 40:1 (3.2 ozs./U.S. gallon).
- **Incorrect type oil.** Generic-brand and some outboard motor mixing oils may not provide sufficient lubrication throughout the broad temperature range associated with high performance air-cooled engine operation.

### IMPORTANT!

When Shindaiwa Premium 2-cycle Engine Oil is not available, fuel should be mixed with a premium-grade 2-cycle mixing oil specifically designed for use in high-performance air cooled 2-cycle engines!

Severe metal galling/transfer all around the piston; even scoring

Figure 2.3 Piston damaged from lack of lubrication.

### Debris (Figure 2.4)

- **Excessive carbon buildup.** Carbon buildup can be dislodged from the exhaust port and jam between piston and cylinder.
- **Operating the engine with a faulty or missing air filter.** Dirt, water, or other debris enters the crankcase and cylinder, scoring the piston and cylinder and causing rapid component wear.

Carbon scoring produces soft-edged grooves on the exhaust side of the piston. Piston rings are still free in the grooves.

Ingested debris produces a sand-blasted appearance or a dull grey surface on the intake side of the piston (away from the arrow). The piston skirt is worn thin at the base. Ring lands are worn.

Ingested water or snow leaves a shiny, polished area on the intake side (away from the arrow)

Figure 2.4 Operating with debris in the cylinder.

## Overheating (Figure 2.5)

- **Operating an engine with clogged or damaged cooling fins or with missing cooling system components**, can cause internal moving parts to expand beyond normal rates and dimensions and allow metal-to-metal contact.

### IMPORTANT!

Overheat damage is most often caused by forcing the engine to turn with excessive trimmer line, dull or oversized attachments, or by failing to select the proper size and capacity trimmer/brushcutter for the application.

- **Preignition** (Figure 2.6) from incorrect spark plug or carbon buildup (may result from lean carburetor setting as well).

- **Incorrect or “lean” fuel-air ratio** (Figure 2.6).

Operating an engine at an oxygen-rich carburetor setting raises combustion temperatures (same effect as pressing the lever on an acetylene cutting torch).

- **Outdated or low-octane fuel** can burn unevenly and unpredictably, producing excessive combustion pressures that tend to have a hammering effect on pistons (Figure 2.7). Shindaiwa engines require a fuel with an octane rating of at least 87 or above. Unless stored fuel has been pre-treated with an approved fuel stabilizer such as Sta-Bil™, Shindaiwa advises against using any motor fuel stored over 30-days.

- **Oxygenated fuels, any fuel containing alcohol or ether-based oxygenating compounds.** So-called “clean air” fuels are blended to provide additional oxygen during the combustion process, producing higher combustion temperatures similar to a “lean” carburetor adjustment. For additional information on oxygenated fuels, refer to the Fuel and Oil section of the Appendix.

- **Air Leaks**

Air leaking past crankcase seals, cylinder gaskets, or impulse passages can dilute or “lean out” an engine’s fuel-air ratio, and can produce the same effect as an improperly adjusted carburetor.

Overheating causes a piston skirt to expand and score heavily on the exhaust side of the cylinder (toward the arrow), and may produce similar (but reduced) scoring on the cooler intake side as well.

Figure 2.5 Damage caused by overheating.

Preignition typically melts the piston crown toward the exhaust side (toward the arrow) of the piston, or may burn a hole completely through the piston crown. Heat causes the piston to expand and score at the exhaust side, sticking rings in their grooves.

Figure 2.6 Damage caused by preignition.

Detonation results when fuel explodes instead of burning, and has a hammering effect that can crack or pound a hole through a piston top, or break a ring land.

Figure 2.7 Damage caused by detonation.



## Troubleshooting Engine Seizure

### IMPORTANT!

Most seizures are not covered by the warranty. Whenever warranty is in question, determine the cause of failure **before** dismantling the engine!

#### General

Outright mechanical failures are unusual, and the cause of a seizure can often be identified by examining the spark plug and by viewing the piston through the cylinder ports.

When making a diagnosis, enter your findings on the Seizure Checklist, shown on the following page.

If an air leak is suspected, the assembled engine should be pressure-tested for possible leakage from crankcase seals or related gaskets.

#### Pressure Testing (Figure 2.8)

Many Shindaiwa trimmers and brushcutters can be pressure tested with Shindaiwa p/n 72174-99200 gauge and block-off kit. Where applicable, the block-off plates are installed over the cylinder ports in place of the carburetor and muffler as shown in Figure 2.8.

If the correct kit and/or block-off plates are not available, small sections of heavy rubber or gasket can be clamped beneath the muffler and carburetor bases.

Once both ports are blocked, a Walbro p/n 57-11 or similar gauge can be used to pressurize the crankcase through an adapter inserted in the spark plug hole.

1. Pressurize the powerhead to 4 – 6 psi for at least 3 minutes.
2. A pressure drop of 2 psi in 3 minutes indicates a leak.
3. Locate leaks with a soap solution  
**or**  
submerge the pressurized powerhead in a tank.

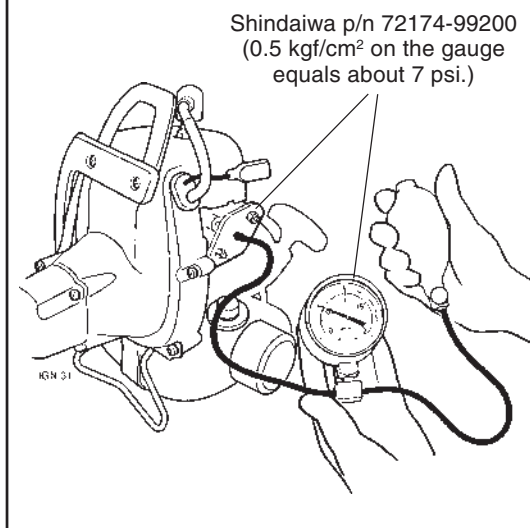


Figure 2.8 Pressure testing a crankcase.

## Seizure Checklist

Shindaiwa P/N 60127



### SEIZURE CHECKLIST

PLEASE CHECK THE APPROPRIATE BOX/RESPONSE

1. Model \_\_\_\_\_ Serial Number \_\_\_\_\_
2. Previous Repair? ..... No ☐ Yes ☐
3. Previous Seizure? ..... No ☐ Yes ☐
4. Gasoline Grade ..... Regular ☐  
Unleaded ☐  
Unleaded Premium ☐
5. Fuel ..... Oil Mix Ratio ☐  
Brand of Mix Oil ☐
6. Was Oil Mixed in Fuel (blotter test)? ..... No ☐ Yes ☐
7. Was Alcohol Present (shaker test)? ..... No ☐ Yes ☐  
Percent: \_\_\_\_\_
8. Carburetor Adjustment (number of turns) ..... High ☐ Low ☐
9. Spark Plug Condition/Color ..... Brown/Tan ☐  
White ☐  
Fouled ☐
10. Plug Manufacturer .....  
Heat Range .....
11. Muffler Outlet Color ..... Black ☐  
White ☐
12. Muffler - Inside ..... Oily ☐ Dry ☐
13. Spark Arrestor ..... No Carbon ☐  
Carbon ☐  
Recently Cleaned ☐
14. Cylinder Exhaust Port ..... Clean ☐  
Heavy Carbon ☐
15. Piston Condition (view through ports):  
Exhaust ..... Clean ☐ Scuffed ☐  
Intake ..... Clean ☐ Scuffed ☐
16. Air Filter ..... Clean ☐  
Dirty ☐  
Torn ☐
17. Flywheel, Cylinder Fins ..... Clean ☐ Damaged ☐  
Debris Clogged ☐
18. Cylinder, Crankcase Bolts ..... Tight ☐ Loose ☐
19. Impulse Line (if equipped) ..... Intact ☐ Torn ☐  
Clear ☐ Plugged ☐
20. Fuel Filter ..... Clean ☐  
Dirty/Plugged ☐
21. Fuel Line (pressure check) ..... OK ☐  
Torn/Leaking ☐
22. Carburetor Inlet Screen ..... Clean ☐ Dirty ☐
23. Boot/Insulator Block ..... Intact ☐  
Torn/Cracked ☐
24. Fuel Vent ..... Clear ☐ Plugged ☐
25. Crankcase/Cylinder Pressure Check (6 psi) ..... OK ☐  
Excessive Leakage ☐

## Introduction

A carburetor's only function is to mix air and fuel to accommodate any combination of engine load and rpm.

All current-model Shindaiwa trimmers and brushcutters use either a **Walbro** rotary valve or **TK** slide valve carburetor fitted with an integral fuel pump. (Noncurrent F-20 grass trimmers use a Walbro WA-135 butterfly-valve carburetor).

During operation, the fuel pump diaphragm responds to crankcase pressure pulses generated by the engine's moving piston. The opposite side of the moving diaphragm then pumps fuel to a *metering chamber* located within the carburetor body (Figure 3.1).

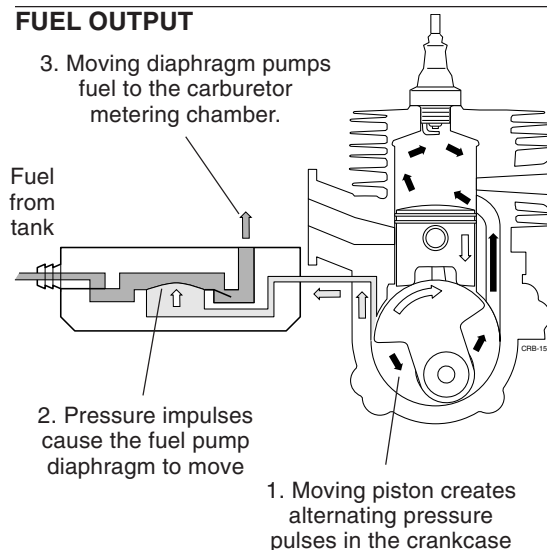
Fuel levels in the metering chamber are maintained by a second diaphragm that actuates an inlet metering needle (Figure 3.2).

Fuel stored in the metering chamber enters the carburetor venturi bore through a throttle-dependent needle seated in a jet or nozzle.

### NOTE:

Both systems regulate air and fuel flow simultaneously, allowing precise mixtures at any throttle setting.

### FUEL OUTPUT



### FUEL INTAKE

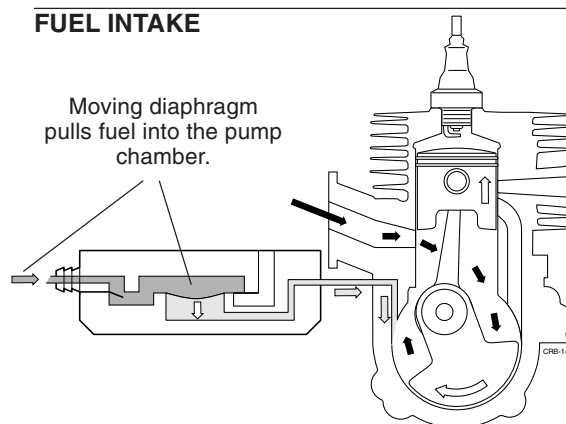


Figure 3.1 Fuel pump operation (typical)

## Operational Comparisons

Both TK and Walbro carburetors:

- Have impulse-driven fuel pumps with internal check valves.
- Store fuel within an internal metering chamber.
- Feature "priming" systems for purging air from the metering chamber during starting operations.
- Utilize a diaphragm-operated inlet valve to maintain metering chamber fuel levels, allowing either carburetor to function in an inverted orientation.
- Regulate fuel delivery by means of a throttle-dependent needle and seat.
- Feature an adjustable venturi area by means of a sophisticated throttle valve.

Beyond obvious physical differences, however, the Walbro and TK carburetors differ significantly in the methods used to perform routine service adjustments.

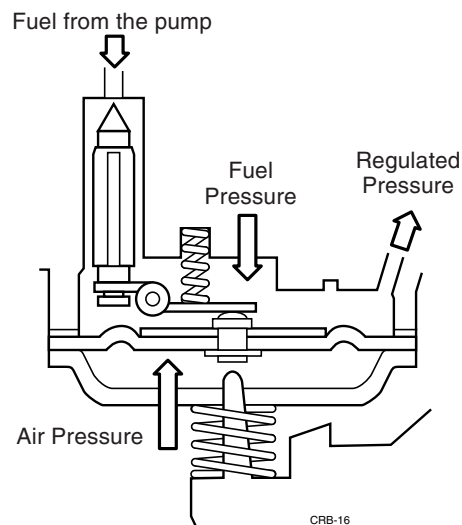


Figure 3.2 Air pressure against the metering diaphragm balances fuel pressure from the pump to maintain a constant fuel level within the metering chamber. The system provides the carburetor's main jet or nozzle with a constantly metered fuel supply, and will function in any position.

## Carburetors By Application

The following is a list of carburetors used on all Shindaiwa trimmers and brushcutters to date.

Three basic types of carburetors are used on Shindaiwa trimmers, brushcutters and edgers: Butterfly, Rotary and Slide-Valve. Carburetors used on all models except the BP-35 feature a metering chamber with a diaphragm for all-position operation. BP-35 carburetor uses a conventional float-valve metering system.

Model	Manufacturer	Type	Carburetor Model
F-18	TK	Slide	DPK8W
F-20	Walbro	Butterfly	WA 135
F-21	Walbro	Rotary	WY 24B
T-18	TK	Slide	WYP-DPK8W
T-20 (early)	Walbro	Rotary	WZ8C
T-20 (late)	TK	Slide	DPV 10W
T-25	TK	Slide	DP10W
T-27	TK	Slide	DPV10W
T/C/LE-230	Walbro	Rotary	WYL-19
T/C/LE-250	TK	Slide	DP-N10W
C-20 (early)	Walbro	Rotary	WZ8C
C-20 (late)	TK	Slide	DPV10W
C-25	TK	Slide	DP10W
C-27	TK	Slide	DPV10W
C-35	TK	Slide	DPVIIW
BP-35	TK	Slide	PC10HW
B-40	TK	Slide	DPW13
B-45	TK	Slide	DPW12
RC-45	TK	Slide	DPW12

# Section 3 Troubleshooting Carburetors

## Troubleshooting

Mechanical failure of any carburetor is far less common than problems resulting from contaminated fuel, improper adjustment, or operator abuse. Figure 3.3 is provided as a troubleshooting checklist. The following pages of this Section provide additional details about these troubleshooting steps.

### IMPORTANT!

Carburetor operation is directly affected by the quality of air and fuel entering the carburetor. Before troubleshooting or adjusting any carburetor, inspect fuel and air filters for cleanliness, operation, and proper installation!

*Troubleshooting requires a systematic search for anything that might prevent the proper quality and mixture of fuel and air from entering being ignited in the combustion chamber and then expelled through the exhaust. This means starting from both the fuel tank and air cleaner, and then working inward until the source of the problem is discovered.*

- |   |  |   |
|---|--|---|
| 1 Inspect the tank vent.  | 7 Check engine compression (Section 7).  | 11 Inspect carburetor passages or valve. Make sure they are not plugged or gummed with dirt or debris. Adjust the carb. |
| 2 Inspect fuel lines.   | 8 Make sure the muffler/arrestor is not plugged.                                   | 12 Check for block pressure leaks by performing a pressure test (page 16).  |
| 3 Inspect the check valve. Make sure it is assembled correctly. | 9 Check the condition of the spark plug (Section 5).                               |   |
| 4 Check the filter element.                                     | 10 Make sure the tank is filled with clean, fresh fuel mixture (see the Appendix). |   |
| 5 Inspect the air filter.                                       |  |   |
| 6 Check the insulator block for air leaks or blockages.         |  |   |

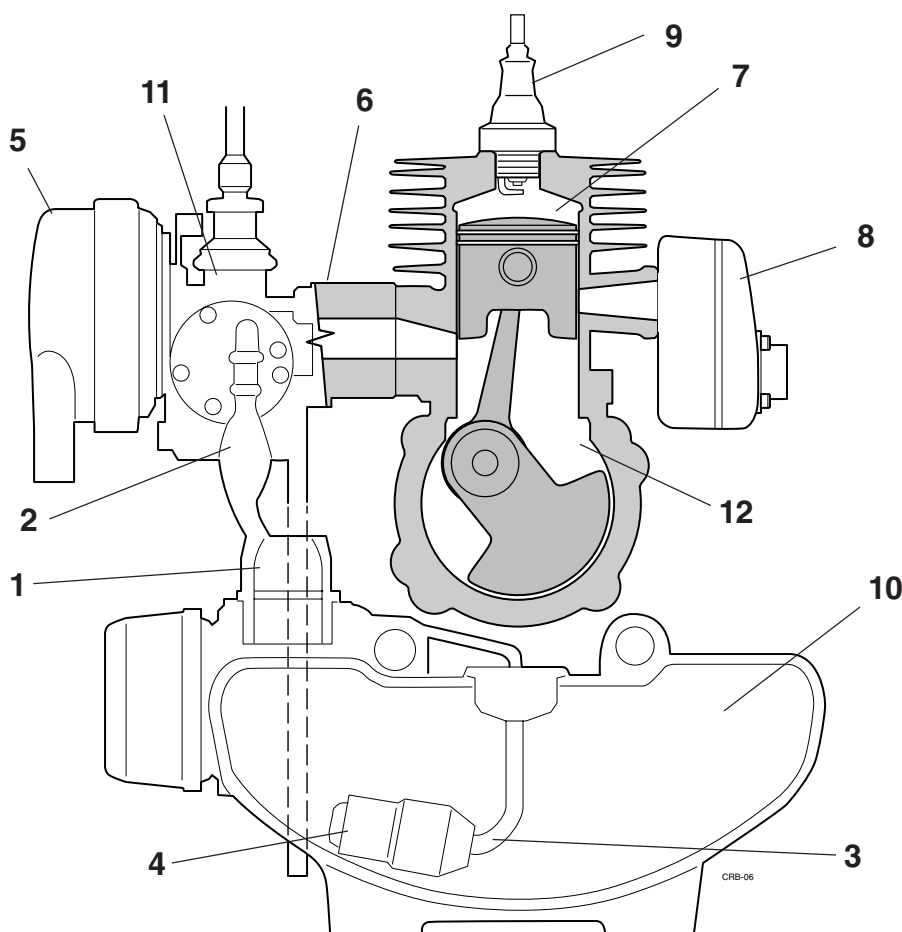


Figure 3.3 Carburetor Troubleshooting Guide

## Fuel Tank, Lines, and Filters

- Test the tank vent for proper operation.
- Inspect fuel lines for signs of deterioration or leaks. If in doubt, remove fuel line and pressurize with a Walbro tester.
- Consult the current Illustrated Parts List (IPL) to verify the requirement and proper installation of an in-line check valve (Figure 3.4).
  - ✦ *A properly installed check valve should permit free passage of fuel toward the fuel tank, but very slow passage in reverse.*
- Verify correct filter components and installation through the current IPL, and inspect the filter element for dirt and debris (Figure 3.7).



### CAUTION!

Dirt or other debris on the inner filter screen may indicate additional debris is trapped within the carburetor body! Trapped debris can restrict fuel flow, possibly leading to engine seizure!

### IMPORTANT!

Most TK carburetors do not contain an internal fuel filter or screen! Dirt or debris entering these carburetors will frequently lodge beneath the inlet needle or within the high speed jet!



### CAUTION!

Use the specified fuel filters only! The modification, substitution, or use of aftermarket fuel filters or components can result in an unbalanced fuel flow within the entire system, and may cause engine performance problems!

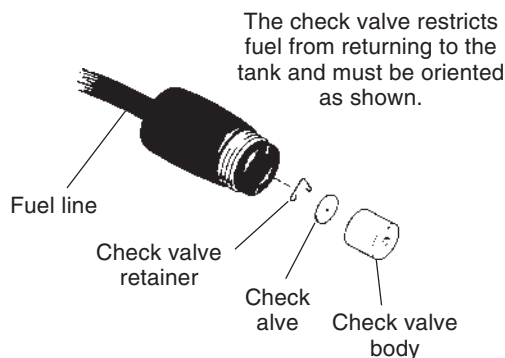


Figure 3.4 Check valve assembly (TK shown)

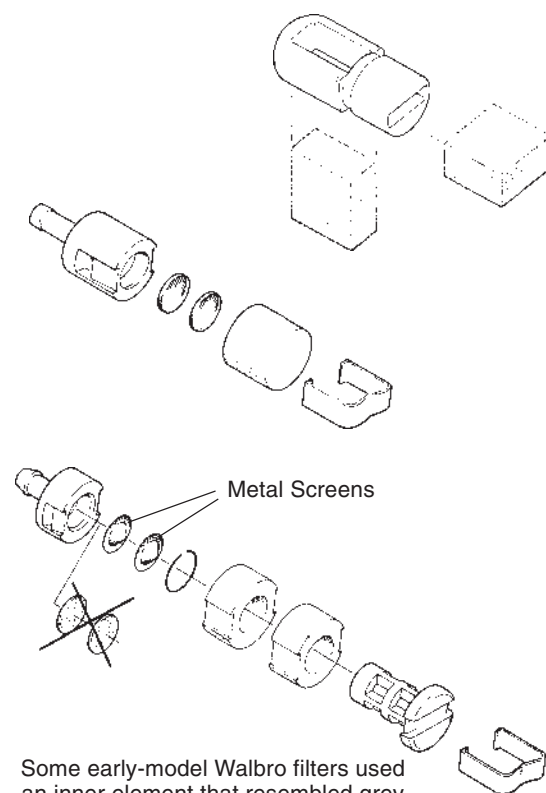


Figure 3.5 Exploded fuel filters, typical

## Section 3 Troubleshooting Carburetors

### Air Filters

All Shindaiwa trimmer/brushcutters use oiled foam air filter elements.

- Consult the current Illustrated Parts List (IPL) to verify correct components and installation! Discard any distorted or deteriorated filter components.

☛ *A clogged but otherwise serviceable foam element should be rinsed in mixed fuel and then squeezed dry before reinstallation*



#### CAUTION!

An engine that has been run with a damaged, distorted, or incorrectly assembled air filter or filter housing should be carefully inspected for internal damage from ingested debris!

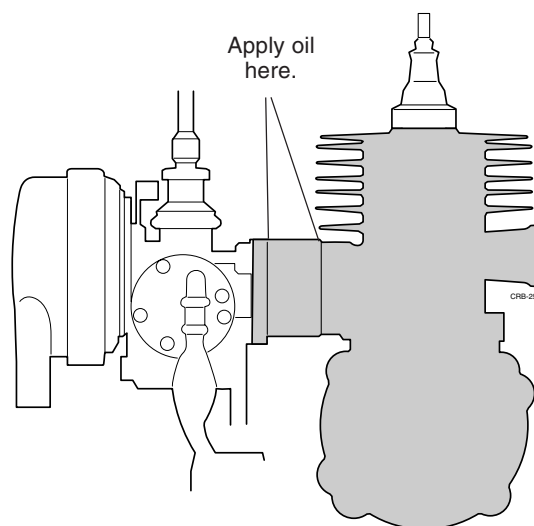


Figure 3.6 Checking the insulator block for air leaks.

### Air Leaks/Pulse Passage

Check for air leaks at the insulator block and gaskets by applying a light film of oil (Figure 3.6). During this test, any change in engine rpm indicates a vacuum leak.



#### CAUTION!

Never use starting fluid or other combustibles to search for air leaks!

Remove the carburetor and place a small drop of oil over the impulse passage. If the impulse passage is clear, the oil droplet should move rapidly in and out during engine cranking (Figure 3.7).



#### CAUTION!

Improper gasket installation or excessive use of Three-Bond™ can block the impulse passage.

Make sure the insulator passages are clear, and that the holes in the gasket align with holes in the insulator block. Do not use sealants to install insulator block gaskets or the carburetor.

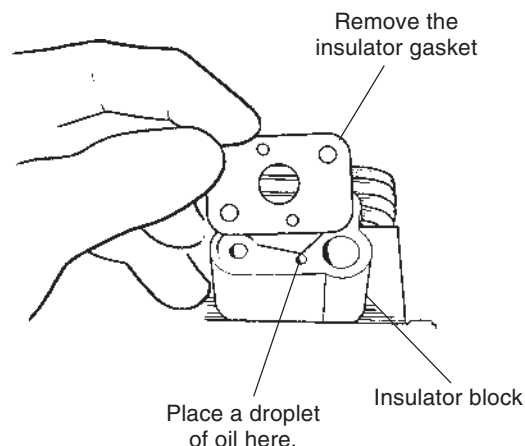


Figure 3.7 Making sure the impulse passage is clear.

### Low Compression/ Vacuum Leaks

Low cylinder compression can cause hard starting and poor performance and may be mistaken for a carburetor problem.

Cylinder compression at cranking speed should be **at least** 85 psi or above.

An irregular idle speed combined with erratic high-speed performance can indicate outside air is entering the engine through a vacuum leak.

If you suspect a vacuum leak, pressure-test the block as described in Section 2.

### Muffler

Backpressure from a clogged muffler or spark arrestor can restrict an engine's high-end performance, or may prevent the engine from firing or starting altogether. Inspect the muffler and spark arrestor for carbon buildup, and if necessary decarbonize as described in Section 9.

### Spark/ Spark Plug

A worn, fouled, misfiring, or incorrectly sized spark plug will affect engine performance and must be replaced before performing further troubleshooting procedures. See also Ignition Section 5.

### Fuel Quality

Stale, dirty, or contaminated fuel must be completely purged from the tank, filter, fuel lines, and carburetor before any further troubleshooting.

If dirt or debris has entered the fuel lines, inspect the filter screen (Walbro) or remove and clean the main jet (TK) before continuing to troubleshoot. When refilling, use only clean, fresh fuel with an octane rating of 87 octane or higher, mixed with Shindaiwa Premium 2-cycle Engine Oil at a ratio of 40:1 (3.2 oz oil per 1-gallon gasoline). Refer to the Fuel and Oil Section in the Appendix.

### Adjustments and Controls

- Inspect idle screws and adjustable jets for proper adjustment. Reset to the specifications listed in the Appendix.
- If tapered needle adjustments appear to have been impacted or overtightened, inspect both needle and seat for damage.



#### CAUTION!

The TK low-speed mixture (air bleed) screw adjustment seats directly into the aluminum carburetor body! Overtightening this screw can permanently damage the aluminum seat, requiring carburetor replacement!

- Inspect the carburetor exterior for signs of visible damage.
- Verify smooth and full-range throttle operation. A cracked or missing cable boot on a TK carburetor can allow air and dirt to enter the carburetor around the slide valve, ruining the carburetor and possibly damaging the engine as well.
- Replace damaged or missing choke components.
- Inspect primer assemblies for leaks and especially (TK) for damaged primer levers or forks (Figure 3.8).

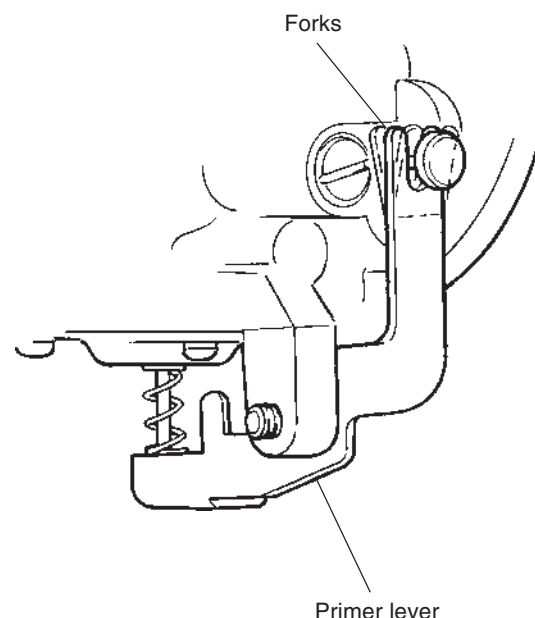


Figure 3.8 TK primer lever, typical



## Section 3 Troubleshooting Carburetors

### Sticking Valves/ Leaks

Use Walbro tool p/n 57-11 or equivalent to test the inlet needle assembly for proper pop-off and reseat pressures (Figure 3.9).

- The pop-off value indicates the pressure required to overcome the inlet needle spring, and should be—
  - for Walbro carburetors, approximately  $30 \pm 10$  psi
  - for TK carburetors, approximately 18 psi.
- The reseat value demonstrates the valve's ability to control fuel pump flow into the metering chamber, and should be—
  - for Walbro carburetors, no less than 10 psi
  - for TK carburetors, no less than 5 psi.

#### NOTE:

For accurate pressure testing, the inlet needle must be slightly wet with fuel or solvent.

If you suspect leakage from the carburetor body itself, submerge the pressurized carburetor in clean solvent and look for bubbles.

#### NOTE:

When leak-testing a Walbro carburetor, the appearance of small bubbles around the fuel pump cover is normal.

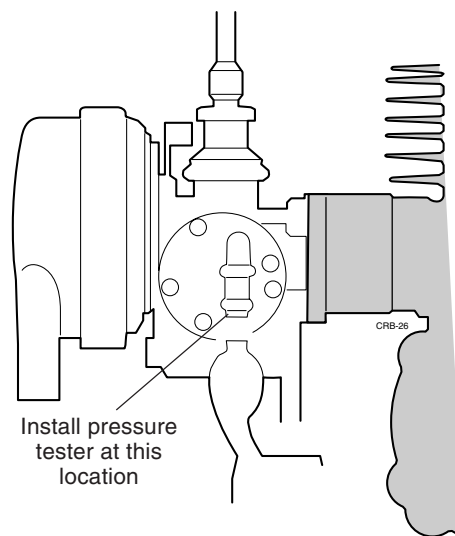


Figure 3.9 Test the inlet needle assembly.

## TK Carburetors Basic Adjustment

All TK carburetors use an adjustable needle valve to regulate fuel flow at the carburetor's main jet.

Most TK carburetors also feature a second needle valve for adjusting low-idle performance. When this low-idle adjustment screw is opened, additional air enters the carburetor on the *engine* side of the throttle valve, which provides a potentially leaner mixture at low-idle throttle settings.

Make initial air screw settings by rotating the idle air screw counterclockwise from the fully closed (clockwise) position.

Recommended initial settings for idle air adjustment screws vary among some engine models, and are listed below.

### Standard TK Carburetor Settings

Model	Slow Air Screw	Main Adjusting Screw
F/T-18	Not Adjustable	1-1/2
LT-20	0-1/2	2 ± 1/4
T/C-20 (Walbro WZ)	mid-point	1-3/8
T/C-20 (TK)	Not Adjustable	2 ± 1/4
T/C/LE-250	Not Adjustable	2 ± 1/4
T/C/LE-25	0-1/2	2 ± 1/2
T/C-27	0-1/2	2 ± 1/4
C-35	0-1/2	2 ± 1/4
B-40	0-3/4	2-3/4 ± 1/4
B-45	0-1/2	2-1/2 ± 1/4

### IMPORTANT!

The TK idle mixture screw (slow air screw) controls air flow, rather than fuel flow! Clockwise rotation of the TK idle mixture screw *reduces* airflow to the engine at idle, causing a richer fuel mixture to enter the engine!

### IMPORTANT!

TK carburetor adjustments vary among some models and applications. Before attempting any carburetor adjustment, refer to the specification table above and in the Appendix.

The TK jet needle is secured in the slide valve by an E-ring and retainer clip and is not meant to be adjusted. For high-altitude operation, however, the needle can be lowered (leaning the mixture) by raising the E-ring (Figure 3.10).

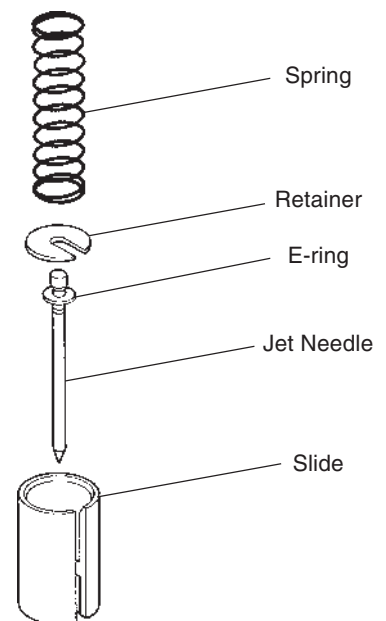


Figure 3.10 The TK slide valve and jet needle must be assembled in the order shown above. The standard position for the E-ring is in the center-most groove at the top of the jet needle. For operation above 2500 feet altitude, the E-ring can be moved to the uppermost groove to provide a leaner fuel-air mixture.

## Section 3 TK Carburetors

### Disassembling TK Carburetors

Figure 3.11



#### CAUTION!

Carburetor components can be easily misplaced or damaged through careless handling or storage. Disassemble a carburetor in a well-lighted area and keep the carburetor and all components in a small tray. Refer to the appropriate Illustrated Parts List (IPL) during both disassembly and reassembly.

#### NOTE:

A pressure tester such as Walbro p/n 57-11, Shindaiwa p/n 72174-99200, or equivalent, is essential for the proper servicing of TK carburetors.

#### A. Carburetor Removal

- STEP 1.** Remove the air filter cover and filter element(s).
- STEP 2.** Remove the air filter body from the carburetor.
- STEP 3.** Unscrew the cap above the slide valve, then remove the cap and slide valve as an assembly.
- STEP 4.** Remove the fuel line and overflow tube from the carburetor body.
- STEP 5.** Remove the two screws securing the carburetor to the insulator block, then remove the carburetor from the engine.

#### B. Inlet Diaphragm

Remove the priming (overflow) lever, cover screws, and cover. Carefully remove the diaphragm and gasket.



#### CAUTION!

Never use scrapers or other metal tools to separate the cover or diaphragm!

#### C. Metering Lever and Valve

- STEP 1.** Remove the metering lever retaining screw.
- STEP 2.** Carefully remove the control lever, pin, and spring.
- STEP 3.** Withdraw the inlet needle. Be especially careful not to damage the needle's Viton™ tip.

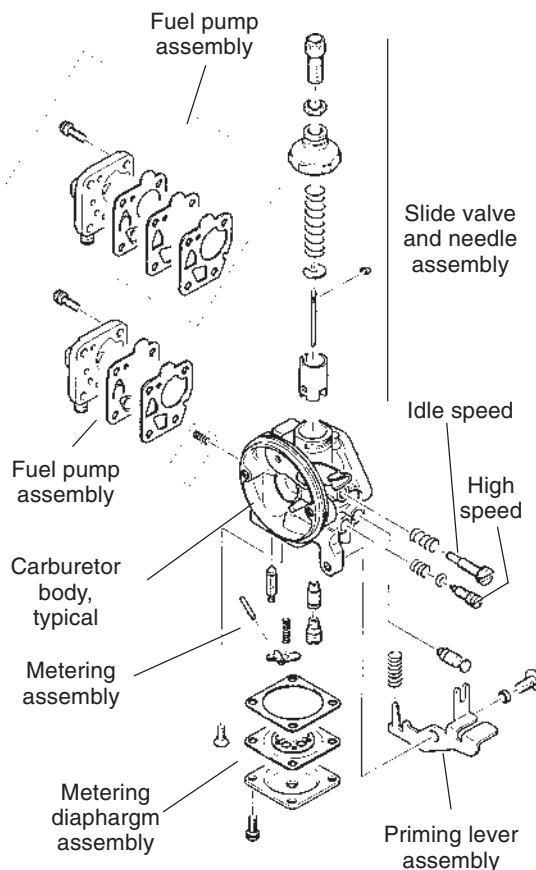


Figure 3.11 Exploded view of typical TK carburetor

## D. Main Jet

Unscrew the main jet holder, and remove the main jet.

### NOTE:

The main jet on model DP-N is not removable. When removing the one-piece jet and O-ring used on early model DP-series carburetors, the O-ring may require have to be removed separately from the carburetor body (Figure 3.12).

## E. Fuel Pump

**STEP 1.** Remove the fuel pump cover screws and lift off the pump cover.

☛ *Carefully note any springs beneath the fuel pump cover, how they are used and oriented (not applicable on all models).*

### NOTE:

If the cover is difficult to remove, it can usually be loosened by “cocking” it a soft-jawed vise.

**STEP 2.** Note the orientation of any alignment tabs protruding from the pump diaphragm and gaskets. Use the IPL as a reference.

**STEP 3.** Gently peel the diaphragm and gaskets from the pump body.

## F. Adjustments

**STEP 1.** Remove the idle stop screw using a counterclockwise rotation.

**STEP 2.** Remove the idle stop spring and the high-speed needle valve. On models with a slow air screw (idle mixture), remove the screw using a counterclockwise rotation.

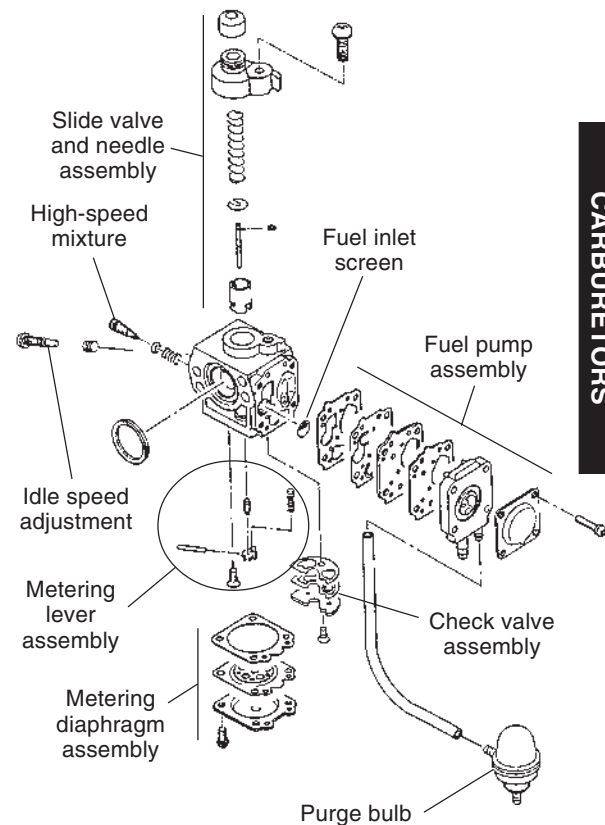


Figure 3.12 Exploded view of TK DP-N carburetor used on Shindaiwa models T/C/LE-250.

## Cleaning

**STEP 1.** Clean all parts in solvent then blow dry.

**STEP 2.** Clean all internal passages with compressed air. If a commercial carburetor cleaner is used, remove it and all residue immediately following its use with conventional solvent.



### CAUTION!

Commercial carburetor cleaners may remove protective internal coatings and casting fillers. Use these cleaners only when absolutely necessary!

## Inspecting TK Carburetors

### A. General

Outright failure of any carburetor is unusual. Most carburetor problems are caused by debris or other fuel-related problems.

- Except for Model DP-N, the TK carburetor contains no internal filter. Carefully inspect the main jet and all passageways for signs of clogging or debris.
- Diaphragms and other non-metallic components can be damaged by exposure to stale fuel or by fuels with an unusually high alcohol content.
- Be alert for stripped fasteners or adjustment screws, as well as any hidden damage.

### B. Carburetor Body

- Clear all passages with compressed air.
  - Discard any carburetor body showing signs of distortion or other damage to any critical surface including mating flanges, threaded holes, cap, and slide bore.
- ☛ *Be especially alert for bending or other damage to the air filter mounting area. This type of damage can cause air leakage; the carburetor should be replaced.*

### C. Slide, Needle, Main Jet

Examine the throttle slide valve for signs of pitting or other mechanical damage. Slide bore wear can be caused by operating an engine with a missing or damaged carburetor cable boot, which allows unfiltered air to leak past the cable and slide.

**The carburetor body is not available separately, so any carburetor with a damaged slide valve bore must be replaced as an entire assembly.**

- Examine the jet needle, and be especially alert for any indication of wear at the needle taper and also at the grooves for the needle retaining clip (see Figure 3.13).
- Whenever wear is discovered at either the needle or jet, replace both components as an assembly.

### IMPORTANT!

If the jet needle shows visible wear, replace both jet and needle as an assembly!

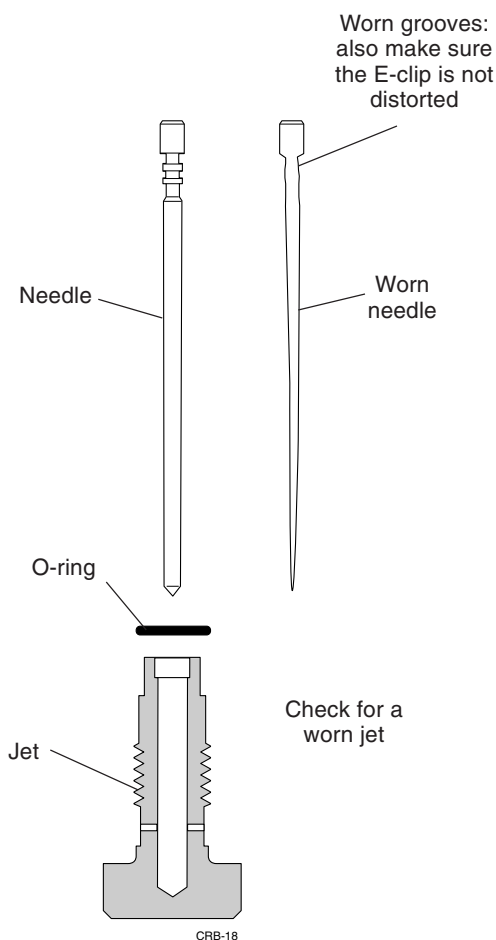


Figure 3.13 Jet and needle (T-25 shown).

## D. Metering Valve Assembly

- Inspect the inlet needle for signs of wear and replace if you discover measurable wear (Figure 3.14).
  - ☛ *When in doubt as to needle serviceability, reinstall the needle and lever assembly and perform the pop-off and reseal pressure test as described on page 24.*
- Inspect the metering lever for signs of wear at the forks, hinge-pin, or from contact with the diaphragm (Figure 3.15).
  - ☛ *Wear in any of these areas will prevent the lever from being properly adjusted, and is cause for rejection.*

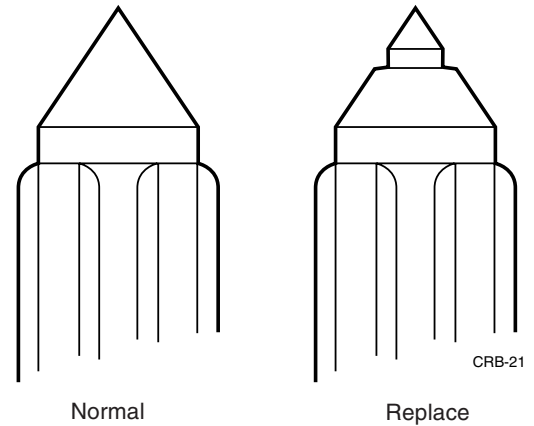


Figure 3.14 Inlet needle

## E. Diaphragms

Inspect diaphragms for cracks or leaks by placing over a lighted flashlight lens or microfiche screen.

- ☛ *A stiff or wrinkled diaphragm has likely been damaged by gasoline with a high alcohol content, and must be replaced.*

## F. Adjustment Screws

Carefully examine adjustment screw tapers and threaded areas for signs of wear or damage.

- ☛ *Damage to either screw's tapered surface requires careful inspection of the nonrenewable seats in the carburetor body, and may require carburetor replacement.*

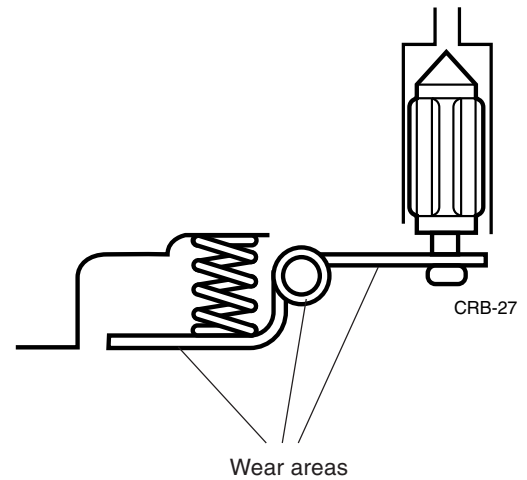


Figure 3.15 Inspect the metering lever for wear.

## G. Priming Assembly

Inspect the air purge valve for any wear or damage that might allow air or fuel leakage during operation. Replace components as required.

- Examine the metal priming lever for bending or distortion at the forks and pivot area, and replace any lever that cannot be straightened to compare with new parts.
- On T/C-25 carburetors, carefully examine the overflow purge valve's internal O-ring seat, and replace if hardened or damaged.

**Inspecting TK Carburetors**  
(continued)

CARBURETORS

**H. Choke Assembly**

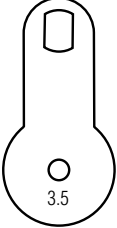
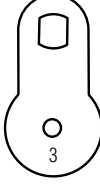
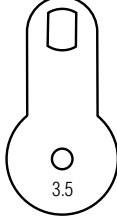
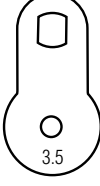




Make sure the choke lever and other choke components are not loose, damaged, or missing.

☛ *Service parts for choke assemblies used on most TK-equipped Shindaiwa products are available as individual part numbers, and are listed on the following chart.*



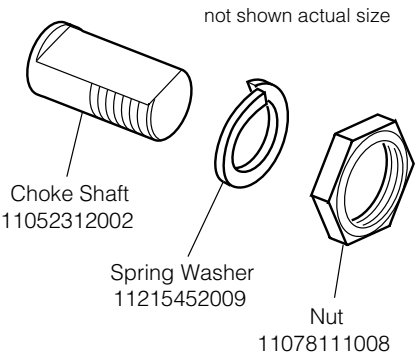
**CAUTION!**

If choke components must be replaced, always stake the choke nut as described below! An improperly staked choke nut could work loose and enter the engine, causing major engine failure!

	HT-20 and T-20	T/C-25	T/C-27	B-45	RC-45
<b>CHOKE PLATE</b> shown actual size  <b>NOTE:</b> WHEN INSTALLING, KEEP BEND OF TAB TOWARD CARB. BODY.	The original choke plate of HT-20 and T-20 units can be removed for reuse by carefully grinding off the head of the choke shaft (rivet) with a small die-grinder or Dremel tool.	 3.5	 3	 3.5	 3.5
		11135711054	1009-2611-30	11272611200	11092611008
<b>CHOKE LEVER</b> shown actual size	An exact replacement choke lever for HT-20 and T-20 units is not available at this time. Part No.11112521103 Lever will work, but the handle tabs are reversed from the original position.	 11112521103	 1012-2521-32	 10092521100	 1012-2521-32

**CHOKE SHAFT, SPRING WASHER AND NUT**  
same parts fit all models

**NOTE:**  
P/N 11052312002 Choke Shaft fits all TK carburetor models listed and must be installed with its threaded end *toward* the air filter. Some choke plates may need to be filed slightly to fit the wider dimension of the new shaft. Correct order of final assembly: (A) choke plate, (B) spring washer and (C) nut. The choke shaft nut should be tightened only enough to provide reasonable resistance when activation the choke. Do not rely on thread locking compounds to lock the nut! **THE CHOKE NUT MUST BE SECURELY STAKED TO THE CHOKE SHAFT!**  
**THERE IS NO WARRANTY FOR INGESTED CHOKE NUTS!**



## Reassembling TK Carburetors

### IMPORTANT!

These are general service instructions only! To verify the correct parts and component orientation for a specific model TK carburetor, always consult the appropriate IPL!

#### A. Main Jet

Install the main jet and jet holder in the reverse order of disassembly.

➔ For models with a one-piece (threaded) main jet, make sure the O-ring is properly placed during jet installation.

#### B. Inlet Metering Valve

Lightly lubricate the metering valve with clean 2-cycle fuel, and then install the valve in the carburetor body.

Install the spring, metering lever, and retaining screw in the reverse order of disassembly. Walbro tool p/n 500-13 can be used to inspect for proper metering lever height (Figure 3.16).

### IMPORTANT!

Metering lever height determines the level of fuel to be maintained in the metering chamber, and must be adjusted to recommended specifications! See the accompanying table.

#### C. Inlet Diaphragm

Install the inlet diaphragm, gasket, and cover in the reverse order of disassembly.

■ On T/C-25 carburetors, make sure the priming (air bleed) O-ring seat is in place and properly oriented before installing the cover. The O-ring seat is properly installed when its flat side is towards the carburetor casting.

Making sure the cover is properly oriented and aligned, cross-tighten the four cover screws.

#### D. Priming ("Tickler") Lever

Reinstall the priming lever in the reverse order of disassembly. Make sure the lever operates smoothly and, if necessary, adjust the lever forks to properly retain the overflow purge valve (Figure 3.17).

### NOTE:

No priming lever adjustment is possible on models T/C-25 carburetor with a red (plastic) priming lever. If the priming valve leaks or if the lever contacts the pump cover on these models, the priming (air bleed) O-ring seat is damaged and must be replaced.

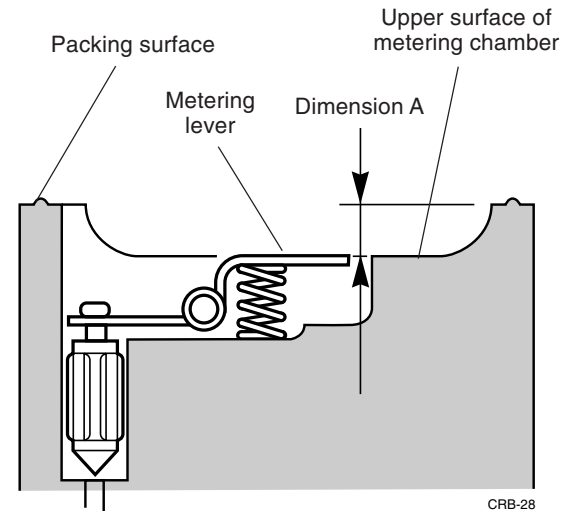


Figure 3.16 Measuring the metering lever height

### TK METERING LEVER SETTINGS

Model	Carburetor Model	Lever Height (Dimension A)
F/T-18	DPK8W-3B	0.083" (2.1 mm)
T/C-20	DPV10W	0.083" (2.1 mm)
T/C-25	DP10W	0.055" (1.4 mm)
T/C-27	DPV10W-1E	0.055" (1.4 mm)
T/C-250	DPN10W-1A	0.083" (2.1 mm)
C-35	DPV11W-1A	0.083" (2.1 mm)
BP-35	PC10WW	0.120" (3 mm)
B-40	DPW13-1A	0.055" (1.4 mm)
B-45	DPW12	0.055" (1.4 mm)
RC-45	DPV-1W-1E	0.083" (2.1 mm)

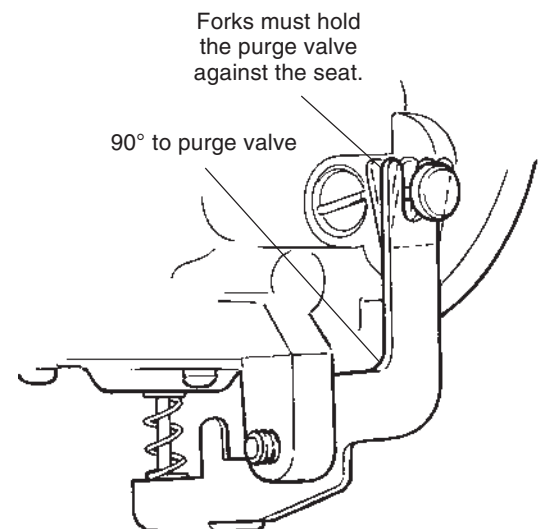


Figure 3.17 Tickler lever adjustments, typical



Reassembling  
TK Carburetors  
(continued)

E. Fuel Pump

Assemble the fuel pump gaskets and diaphragms in the reverse order of disassembly.

- Where multiple gaskets and diaphragms are specified, assembly is correct when exterior tabs are in a “stepped” orientation. See Figure.3.11.
- Install any flapper-valve springs removed during disassembly, and then install and securely tighten the pump cover.

F. Adjustment Screws

Replace the high-speed and (where used) low-speed mixture screws, then adjust each to the specifications listed on the adjacent chart and in the Appendix. Assemble the idle-speed screw and spring, and thread the screw approximately 5 turns into the carburetor body.



CAUTION!

Do not overtighten tapered adjustment screws! Overtightening these screws can damage the adjustment seats inside the carburetor body, requiring carburetor replacement!

Standard TK Carburetor Settings

Model	Slow Air Screw	Main Adjusting Screw
F/T-18	Not Adjustable	1-1/2
LT-20	0-1/2	2 ± 1/4
T/C-20 (Walbro WZ)	mid-point	1-3/8
T/C-20 (TK)	Not Adjustable	2 ± 1/4
T/C/LE-250	Not Adjustable	2 ± 1/4
T/C/LE-25	0-1/2	2 ± 1/2
T/C-27	0-1/2	2 ± 1/4
C-35	0-1/2	2 ± 1/4
B-40	0-3/4	2-3/4 ± 1/4
B-45	0-1/2	2-1/2 ± 1/4

Installing and  
Adjusting TK  
Carburetors

**STEP 1.** Assemble the slide and needle in the exact order as shown in Figure 3.18.

- Make sure the needle retainer is correctly placed between the jet needle and spring, and that the jet needle clip is properly positioned (standard position is in the middle groove).
- Making sure the rubber throttle cable boot is in good condition and is in place on the carburetor cap, install the throttle cable into the slide and needle assembly in the reverse order of disassembly.

NOTE:

Prior to carburetor installation, the carburetor should be pressure tested for pop-off and reseal pressures as described in the Trouble-shooting Section of this Chapter. In addition, leak-test the carburetor body by pressurizing the carburetor in a small can of solvent.

**STEP 2.** Using a new gasket, assemble the carburetor to the insulator block and firmly tighten the carburetor mounting screws. (TK carburetor model DP-N is boot-mounted, and does not use a gasket.)

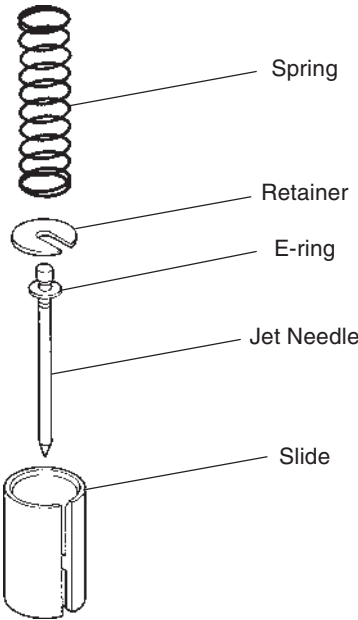


Figure 3.18 Slide and needle assembly



## CAUTION!

The carburetor mounting gasket must be installed **dry!** Use of silicone or other sealants can block the insulator impulse passage! A blocked impulse passage can restrict fuel delivery, possibly leading to serious engine damage!

**STEP 3.** Install the throttle cap and slide valve assembly on the carburetor. The slide valve has a vertical slot that must engage with a locating pin in the slide valve bore.

**STEP 4.** Connect fuel and priming discharge lines in the reverse order of disassembly.

**STEP 5.** Install the air filter elements in the reverse order of disassembly. Install any remaining ducting or covers removed during disassembly.



## CAUTION!

Screen-type elements **must** be installed with the **large-mesh** (black) screen on the **engine side** of the filter! Incorrect screen orientation can lead to serious engine damage from ingested debris!

**STEP 6.** Fill the fuel tank with fresh 2-cycle fuel. Start and warm the engine, and adjust idle air mixture as described in the Basic Adjustment section (page 25). Using a reliable tachometer, adjust low idle engine speed to the specification listed in the Appendix.

**STEP 7.** Set the engine throttle lever to the "full" (W.O.T.) position, and then adjust the carburetor main-jet (high speed) screw until the engine "peaks" at maximum no-load rpm. As soon as maximum rpm has been established, *enrich* (unscrew) the high speed adjustment in 1/8-turn increments until the engine begins to "stutter" slightly.

**STEP 8.** Recheck idle speed and performance, and adjust as necessary.



## CAUTION!

Operating a 2-cycle engine at peak rpm (lean mixture) can cause permanent engine damage from overheating!



## CAUTION!

Avoid engine overheat damage! Fuels containing alcohol or other oxygen-bearing compounds can increase engine operating temperatures! When a 2-cycle engine must be operated with oxygenated fuel, you must compensate for the additional oxygen by slightly enriching (unscrewing) the high speed adjustment screw! Additional information on oxygenated fuels is provided in the Fuel and Oil Section of the Appendix.

## Walbro Carburetors Basic Adjustment (Figure 3.19)

### Basic Adjustment

The Walbro carburetor contains no separate internal circuitry for idle-speed operation.

When servicing the Walbro carburetor, adjust idle speed mixture by raising and lowering a threaded fuel needle in the center of the carburetor's rotary barrel valve.

- Make initial settings by completely removing the needle in a counterclockwise direction, then reinstalling it to the specifications listed in the Appendix.
- Make fine adjustment in 1/8-turn increments with the engine warmed to normal operating temperature. Rotating the needle in and then out to locate a position midway between "lean idle" and "rich idle" operation.

Walbro high-speed adjustments vary by model. Make adjustments either by turning an adjustable mixture screw or by replacing the main jet with one of a different size (larger or smaller).

*Adjust idle mixture on Walbro Models WYL, WYM, WY and WZ carburetors by raising or lowering the inner needle screw in the center of the carburetor's barrel valve. Since the needle has no seat, an initial starting or reference point can only be obtained by completely withdrawing the needle, then reinstalling it to the specific number of turns as listed below. Turns are counted after initial thread engagement. Make subsequent adjustments in 1/8-turn increments; make fine adjustments with the engine warm and running at a fast idle. Adjust the needle screw to produce the highest engine rpm, then richen the mixture slightly by turning the mixture screw an additional 1/4-turn counterclockwise.*

#### WY

Initial setting: 7–8 turns  
Models F/T-18 (not current)

#### WZ

Initial setting: 5–6 turns  
Model T-20 (not current)

#### WYL

Initial setting: 12–13 turns  
Models T/C-230, LE-230

#### WYM

Initial setting: 12–13 turns  
Models 300, 300S

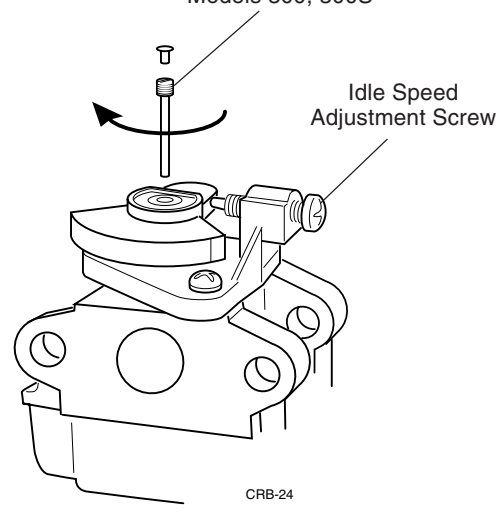


Figure 3.19 Walbro fuel mixture adjustment.

## Dissassembling Walbro Carburetors

### NOTE:

Model WYL is typical of current model Walbro carburetors used on Shindaiwa trimmers and brushcutters (Figure 3.20).

Walbro carburetor model WZ used on early model T-20 units are described at the end of this Section.

### NOTE:

Walbro p/n 57-11 pressure tester or equivalent is essential for proper service of Walbro carburetors. In addition, the Walbro tool kit p/n 500-500 can simplify many Walbro service and repair procedures.

### A. Carburetor Removal

(WYL shown. When servicing other models, refer to appropriate IPL)

**STEP 1.** Open the air filter cover to expose the two carburetor retaining screws.

**STEP 2.** Remove the carburetor retaining screws, and remove the air filter assembly.

**STEP 3.** Using finger pressure only, slide the overflow tube retainer past the barb on the overflow outlet fitting.

**STEP 4.** Gently pull both the fuel line and overflow tube from the carburetor body.

**STEP 5.** Disconnect the throttle control wire from the throttle lever assembly, then remove the carburetor from the powerhead.

### B. Air Purge (Primer Bulb)

**STEP 1.** Unscrew the four metering cover retaining screws, and then remove the cover, primer pump bulb (Figure 3.21), and the plastic purge body assembly.

**STEP 2.** Using the flat tip of a small screwdriver, carefully remove the check valve.



### CAUTION!

Never use scrapers or other metal tools to separate carburetor covers, gaskets, or diaphragms!

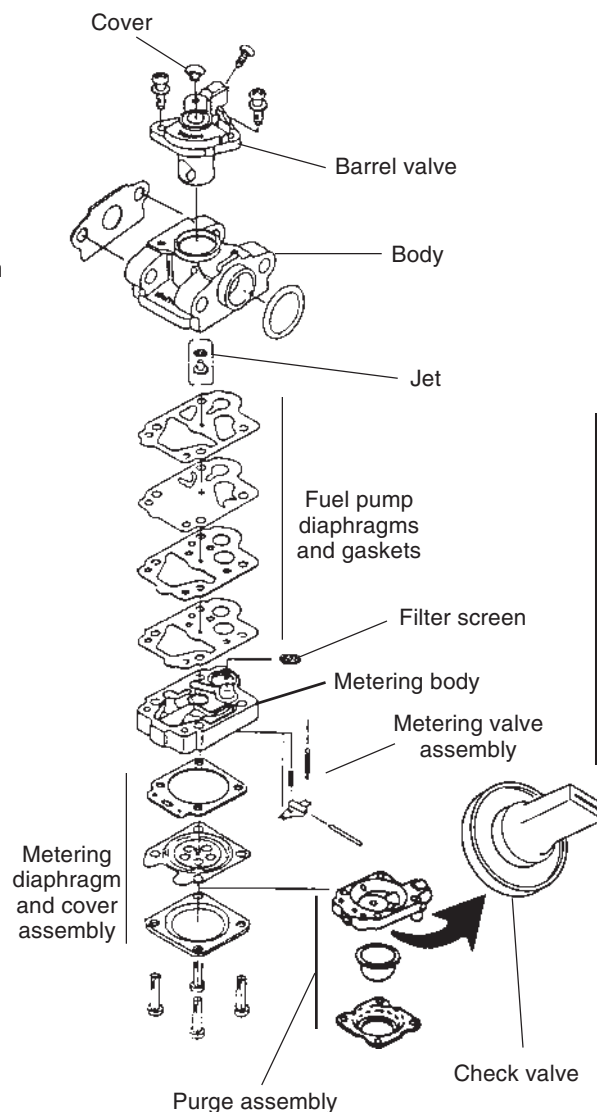


Figure 3.20 Walbro WY-series carburetor.

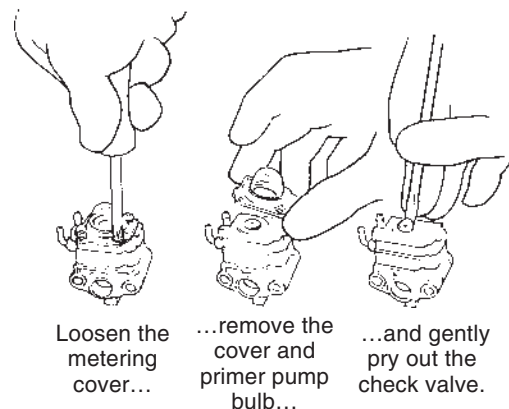


Figure 3.21 Servicing the check valve

## Dissassembling Walbro Carburetors (continued)

### C. Metering Diaphragm and Pump

**STEP 1.** Gently peel the metering diaphragm and gasket from the pump body casting.

**STEP 2.** Lift the pump body from the carburetor base and throttle assembly.

### D. Metering Lever and Inlet Valve

Remove the metering lever retaining screw, then carefully lift out the metering lever and pin, inlet valve, and metering lever spring.

### E. Pump Body Assembly

If the inlet screen is to be cleaned or replaced, gently pry it from the pump body.

☛ *Use care to avoid nicking or otherwise damaging either the screen retaining bore or the machined pump body mating surface.*

### F. Venturi Body Assembly

**STEP 1.** Use a small pick to gently pry the main jet and (where used) O-ring from the venturi body assembly.

**STEP 2.** Turn the venturi body over, and remove the two phillips-head screws securing the throttle valve assembly.

**STEP 3.** Using hand pressure only, carefully lift the throttle valve assembly from the venturi body.

### G. Throttle Valve Assembly

**STEP 1.** Use a small pick to gently pry the plug from the center of the throttle lever. This exposes the recess in which the inner idle needle is housed.

**STEP 2.** Using a small screwdriver, turn the inner idle needle **counter-clockwise** to remove.

**STEP 3.** Remove the inner idle needle and spring.

## Cleaning

Clean all internal passages with compressed air. If a commercial carburetor cleaner is used, remove it and all residue immediately following its use with conventional solvent.



### CAUTION!

Commercial carburetor cleaners may remove protective internal coatings and casting fillers. Use these cleaners only when absolutely necessary, and for brief periods **only!**

### Inspecting Walbro Carburetors

#### A. General

Outright failure of any carburetor is unusual. Most carburetor problems are caused by debris or other fuel-related problems.

- During disassembly, closely examine internal jets and passageways for signs of accumulated dirt or debris.
- Diaphragms and other non-metallic components can be damaged by exposure to stale fuel or by fuels with an unusually high alcohol content.
- Be alert for stripped threads on fasteners or adjustment screws, as well as any hidden physical damage.

#### B. Throttle body and Nozzle

Inspect the throttle body casting for damage such as stripped threads, cracks, distortion, damaged nozzle, etc.

☛ *If the throttle casting is worn or damaged beyond serviceability, the entire carburetor must be replaced.*

#### C. Barrel Valve

- Rotate the throttle lever by hand. The barrel valve should raise and lower smoothly with no side-to-side movement.
- Inspect the throttle lever and cable fitting for damage or unusual wear. Replace if noted.
- Inspect the idle stop screw lug for cracking or stripped threads. If such damage is discovered, replace the entire valve assembly.

#### D. Main Jet and O-Ring

Damage to the main jet is unusual since the jet can be usually cleaned in solvent and then cleared with compressed air.

☛ *A replacement O-ring is included with the Walbro gasket and diaphragm repair kit.*

## Inspecting Walbro Carburetors (continued)

### E. Pump Body

- Inspect the pump body casting for damage or corrosion. Make sure the fuel inlet, air purge tube, and pasageway plugs are tightly in place. If you discover any of these problems, replace the pump casting
- Use a straightedge to determine if the body's machined mating surfaces are warped. If you discover warpage, replace the pump casting.

### Metering Valve

- Inspect the inlet needle for signs of measureable wear or distortion at the tip or shank, and replace if noted (Figure 3.22).
  - ☛ *When in doubt as to needle serviceability, reinstall the needle and lever assembly and pressure-test for pop-off and reseal as described on page 24.*
- Inspect the metering lever for signs of wear at the forks, hinge-pin, or from contact with the diaphragm (Figure 3.23).
  - ☛ *Wear in any of these areas will prevent the lever from being properly adjusted. Replace the lever.*

### Diaphragms

Inspect diaphragms for cracks or leaks by placing them over a lighted flashlight lens or microfiche screen.

- ☛ *A stiff or wrinkled diaphragm has likely been damaged by gasoline with a high alcohol content, and must be replaced.*

### Adjustment Screws

Examine the idle stop screw and replace if bent or otherwise damaged.

- ☛ *The inner idle needle isn't considered a wear part and is not available separately.*

### Air Purge/Priming Assembly

- Inspect the air purge bulb and check valve for deterioration. Replace components as required.
- Inspect the primer pump body for cracks or physical damage. Replace if noted.

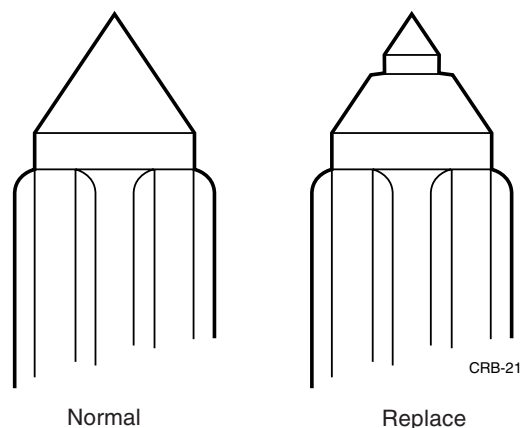


Figure 3.22 Inlet needle

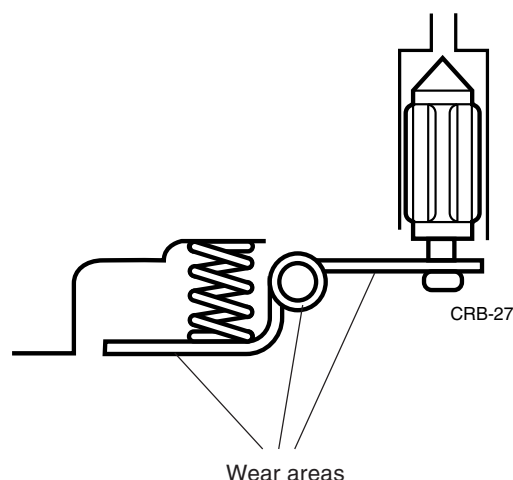


Figure 3.23 Inspect the metering lever for wear.

## Reassembling Walbro Carburetors

### A. Throttle Valve and Venturi Body

**STEP 1.** Install the inner idle screw and spring in the reverse order of disassembly.

- Initial settings for the inner idle adjustment screw vary between models and are listed at the beginning of the Walbro Carburetor section. Make settings from initial thread engagement during inner idle screw installation.

**STEP 2.** Replace the throttle valve assembly on the venturi body, then install and tighten securely the two throttle valve collar screws.

**STEP 3.** Using hand pressure only, assemble the main jet and O-ring, then install the jet in the venturi body.

### B. Pump Body Assembly

- If the fuel inlet screen has been removed, install a new screen.
- Install the pump diaphragm and gasket in the reverse order of removal, then fit the pump body to the venturi body assembly.

### C. Metering Lever and Inlet Valve

**STEP 1.** Lubricate the inlet valve with a few drops of fresh fuel mixture, then install the valve, spring, metering lever, and pin. Secure them all by firmly tightening the phillips-head metering-lever screw.

**STEP 2.** Adjust the metering lever height to  $0.059" \pm 0.005$  using a Walbro gauge p/n 500-13 or a straightedge and thickness gauge (Figure 3.24).

### D. Metering Diaphragm and Pump

**STEP 1.** Install the diaphragm, gasket, and purge body on the pump body assembly.

**STEP 2.** Using finger pressure only, install the check valve.

**STEP 3.** Fit the primer pump bulb and cover, and then secure the cover with the four cover screws.

### E. Pressure Testing

Connect a Walbro tester p/n 57-11 or equivalent to the carburetor fuel inlet fitting and test the carburetor for the appropriate pop-off and reseal pressures as described on page 24.

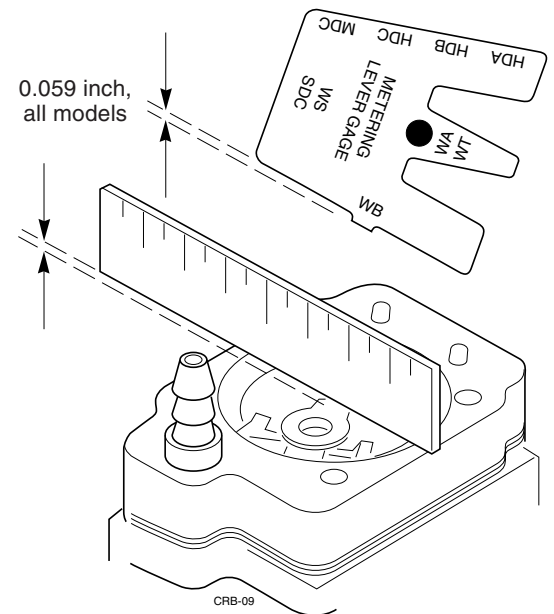


Figure 3.24 To measure the metering lever height, place a straightedge across the pump body casting. The metering lever should be  $0.059" \pm .005$  below the straightedge. Slight pressure will bend the metering lever up or down for adjustment.



## Installing Walbro Carburetors

**STEP 1.** Connect the throttle control wire.

**STEP 2.** Place a new carburetor mounting gasket on the insulator block.

☛ *Make sure the insulator block impulse passageway and gasket are properly aligned, then assemble the carburetor and air filter to the insulator block with the two carburetor mounting screws.*



### CAUTION!

The carburetor mounting gasket must be installed **dry**! Use of silicone or other sealants can block the insulator impulse passage! A blocked impulse passage can restrict fuel delivery, possibly leading to serious engine damage!

**STEP 3.** Install the fuel and priming discharge lines and hose retainers in the reverse order of disassembly.

**STEP 4.** Reinstall any covers or ducting removed during disassembly.

**STEP 5.** Fill the fuel tank with fresh 2-cycle fuel. Start the engine and adjust the idle mixture as described at the beginning of the Walbro Carburetor section of this chapter.

**STEP 6.** Adjust low idle engine speed using a reliable tachometer. Refer to the per-model specifications in the Appendix.

## Walbro WZ Carburetors (Figure 3.25)

The WZ carburetor is used on early model T-20 trimmers and uses a barrel valve throttle system. The WZ carburetor is fitted with an adjustable main jet and also features a unique primer system instead of a conventional choke valve.

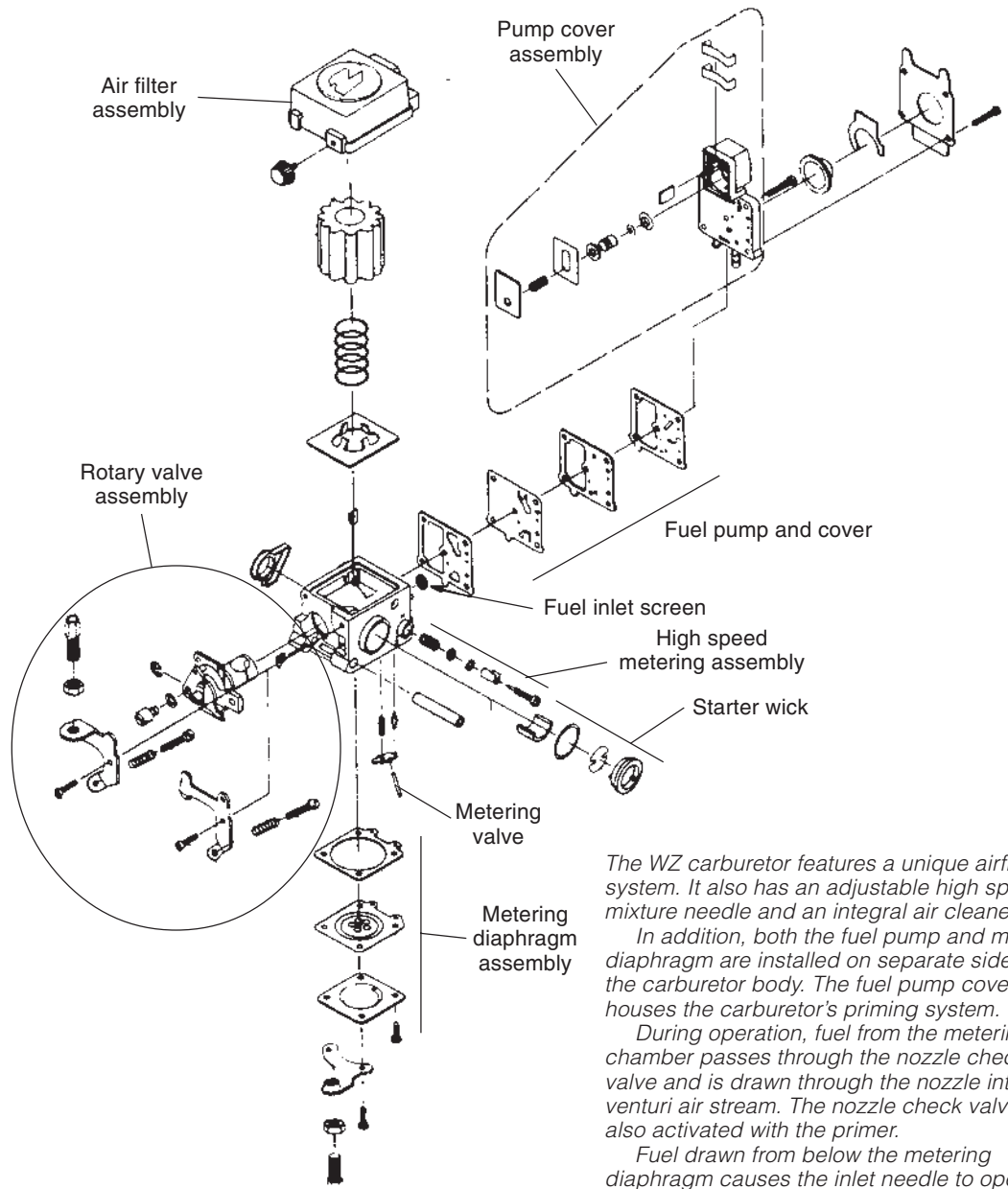
### A. High Speed Mixture Adjustment

- STEP 1.** Preset the high speed mixture screw to 1-1/2-turns counter-clockwise from the fully closed (clockwise) position.
- STEP 2.** Start the engine, and hold the throttle at a fast idle until reaching operating temperature.
- STEP 3.** Set the throttle to the "wide open" (W.O.T.) position, and then slowly turn the high speed mixture screw in, then out to establish an adjustment midway between over-rich and over-lean.



### CAUTION!

Prolonged or repeated lean operation can cause engine seizure!



The WZ carburetor features a unique airflow system. It also has an adjustable high speed mixture needle and an integral air cleaner.

In addition, both the fuel pump and metering diaphragm are installed on separate sides of the carburetor body. The fuel pump cover also houses the carburetor's priming system.

During operation, fuel from the metering chamber passes through the nozzle check valve and is drawn through the nozzle into the venturi air stream. The nozzle check valve is also activated with the primer.

Fuel drawn from below the metering diaphragm causes the inlet needle to open, allowing the fuel pump to refill the chamber.

Figure 3.25 Walbro WZ Carburetor, used on Shindaiwa T-20 grass trimmers to serial number 0089960.

## Walbro WZ Carburetors (continued)

### B. Primer Systems

The WZ carburetor uses a primer system instead of a conventional choke valve. The system draws fuel during routine air purge operations, and includes a starter box, a starter button, a wick, and several check valves.

For engine startup, the flow sequence is as follows:

- 1 Squeezing the purge bulb diverts a metered quantity of fuel to the WZ's primer circuitry.
  - Most of this fuel is stored under pressure in a chamber connected to the starter box.
  - A small amount of fuel also passes through a check valve and is injected into the venturi through the main nozzle.
- 2 Pressing the starter button allows fuel stored at the starter box to saturate a porous foam wick located just inside the carburetor bore.
- 3 During cranking, the raw fuel injected at the carburetor nozzle is immediately drawn into the engine's crankcase and combustion chamber.
- 4 As the engine starts, air entering the carburetor bore becomes saturated with fuel from the starter wick.
- 5 As the starter wick runs out of fuel, the engine warms and no longer requires a fuel-rich mixture.

## Troubleshooting the WZ Carburetor

Troubleshooting the primer and air purge systems usually requires no more than cleaning and servicing the check valves and bulb.

Before troubleshooting, inspect and clean the fuel filter as required. Inspect and replace any plugged or deteriorated fuel lines as well, and replace any primer/purge bulb showing evidence of cracking, leaking, or hardening.

### **PROBLEM: The primer will not depress**

1. Inspect the fuel return line for kinks or plugging. Repair or replace as required.
2. The discharge valve may be plugged. Clean and retest as required.

### **PROBLEM: The primer remains collapsed**

1. The inlet valve may be stuck in the closed position. Clean and retest as required.
2. There may be a restriction in the fuel line or filter. Repair as required.

### **PROBLEM: The primer fills with air**

1. There may be a leak in the fuel line. Pressure-test the line and replace as required.
2. The discharge check valve may be stuck open. Clean and retest as required.
3. The nozzle check valve may be stuck open. Clean and retest as required.
4. **Butterfly carburetors** Close both needles and operate the air purge. If the bulb fills with fuel, the check valve is stuck open. Clean the valve and retest as required.

## IMPORTANT!

Any defect that prevents the carburetor from getting fuel to the engine will also prevent the air purge or primer from working!

☛ **Tip on testing check valves.** A check valve can be tested by covering the valve with one end of a clean primer hose and then blowing/pulling air through the hose to confirm valve operation.

☛ **Tip on replacing check valves**  
(Walbro p/n 84-555)

**STEP 1.** Screw a small sheet metal screw into the hole in the center of the check valve.

**STEP 2.** Grasp the sheet metal screw with pliers, then extract and discard the defective check valve.

**STEP 3.** Install a new valve and press it in to the same depth, **or** Use Walbro tool kit p/n 500-500 and follow the procedures outlined with the kit.

## Section 4 Recoil Starters

### General

All Shindaiwa trimmers and brushcutters use a manual starting system that permits an operator to generate engine cranking speed by pulling on a rope wound around a pulley or reel.

When the operator pulls rapidly on the starter rope, a ratchet mechanism temporarily connects the moving starter pulley to a hub mounted on the engine's crankshaft. Extending the rope also winds a clock-type spring contained in the starter housing.

When the rope has been pulled to the end of its travel, energy stored in this *recoil spring* can be used to automatically rewind the starter rope around the pulley.

#### IMPORTANT!

Most recoil starter failures are caused by abusive engine cranking procedure and can usually be traced to a "hard starting" engine! When you encounter a starter with a frayed rope, broken rewind spring, or similar mechanical damage, *always* verify both engine condition and operator starting procedures!

### Variations by Model

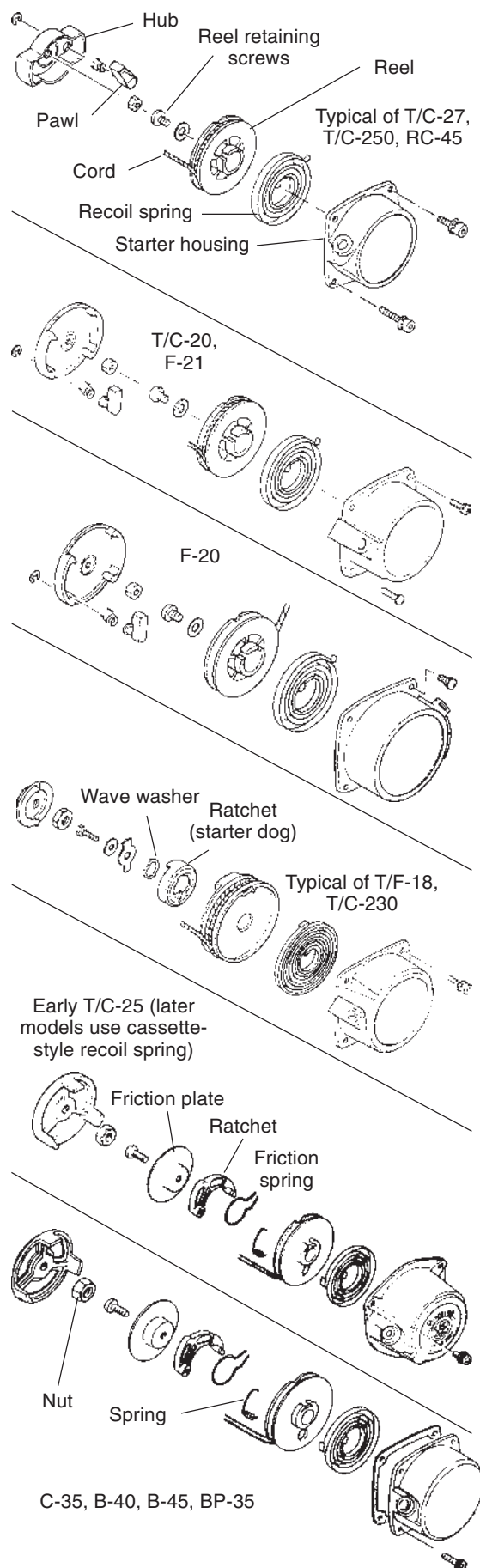
Recoil starting systems used on Shindaiwa trimmers and brushcutters can be divided into the four basic types as shown in Figure 4.1.

Since variations exist within types, starters are not generally interchangeable between models.

#### IMPORTANT!

Starter component specifications and orientation sometimes vary widely between models and model series! Before ordering or replacing any Shindaiwa recoil starter or related components, always consult the appropriate Illustrated Parts List (IPL) as well as applicable service bulletins!

Figure 4.1 All four basic starter types are used on Shindaiwa trimmers and brushcutters. Recoils are not generally interchangeable between models, and both mounting systems and dimensions may vary. Although some internal components may be interchangeable, consult the appropriate Illustrated Parts List before attempting to substitute parts for dissimilar models.



## Disassembling the Recoil



### WARNING!

Wear eye and face protection when servicing recoil starters! Coiled starter springs contain stored energy and may cause injury if suddenly released!

Remove the 3 or 4 fasteners that secure the recoil starter housing to the engine crankcase.

### Release Spring Tension

Pull 8 to 10 inches of starter cord from the recoil housing and tie a slip knot (Figure 4.2) where the cord enters the housing.

#### ■ If the cord is to be replaced:

Cut the cord where it enters the handle. Untie the slip knot in the starter cord and allow the cord to rewind slowly back into the housing.

#### ■ If the cord is to be reused:

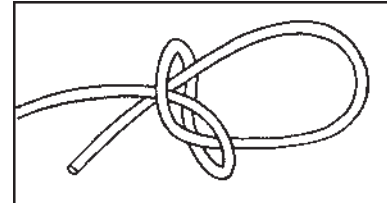
Use a needle-nose pliers to withdraw the knot from the operator-side of the starter handle. Untie the knot, then slide the handle from the cord. Untie the temporary knot at the recoil housing, then allow the cord to rewind slowly back into the housing.

### Remove the Reel Retaining Screw

Use a screwdriver to remove the recoil reel retaining screw. Turn counter-clockwise (all models).

### NOTE:

The reel retaining screw is precoated with a screw-locking agent to prevent it from loosening during operation. To ease its removal from a cast metal recoil housing, first heat the housing threads to approximately 212F° (100C°) with a heat gun.



Tie a slip knot to prevent the starter cord from rewinding into the housing.

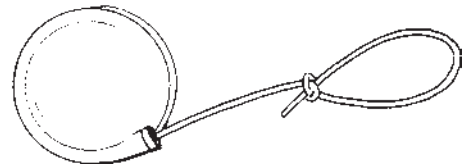


Figure 4.2 Slip knot

## Disassembling the Recoil (continued)

### Remove the Starter Reel



#### WARNING!

Wear appropriate eye and face protection! Use care when working with recoil springs!

#### IMPORTANT!

Before and during removal, note both orientation and order of disassembly.

**STEP 1.** Carefully remove all components *except* the starter reel.

**STEP 2.** Carefully remove the starter reel. On most models, the recoil spring remains in the housing.

☛ *On some models including F/T-18, T/C-230, the recoil spring will be removed with the reel assembly.*

**STEP 3.** Remove the spring from the recoil housing or reel using a needle-nose pliers (Figure 4.3).

☛ *If the spring is to be reused, it can be easily stored inside a loop of wire or small-diameter jar lid such as a baby-food jar.*

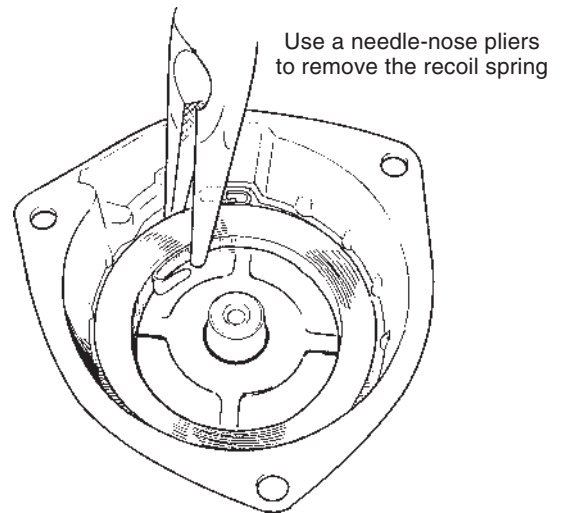


Figure 4.3 Removing the recoil spring

## Removing the Hub

### NOTE:

Failure of a starter hub is unusual. It is generally not necessary to remove the hub assembly for inspection. If the hub must be removed for service, follow the procedure outlined below:

**STEP 1.** Lock the engine crankshaft by inserting a plastic piston stop or length of starter cord through the spark plug hole (Figure 4.4).

**STEP 2.** Using the appropriate socket wrench, remove the starter hub retaining nut. Turn counter-clockwise (all models).



#### CAUTION!

The starter hub is also threaded onto the engine crankshaft! **Never** use pullers or prying tools to remove the starter hub!

**STEP 3.** Unscrew the starter hub (counter-clockwise, all models) and remove it from the crankshaft.

#### IMPORTANT!

Some starter hubs contain an internal ratchet or pawl! Before further disassembly of these hubs, note the location and orientation of the starter pawl, spring, and pawl retainer!

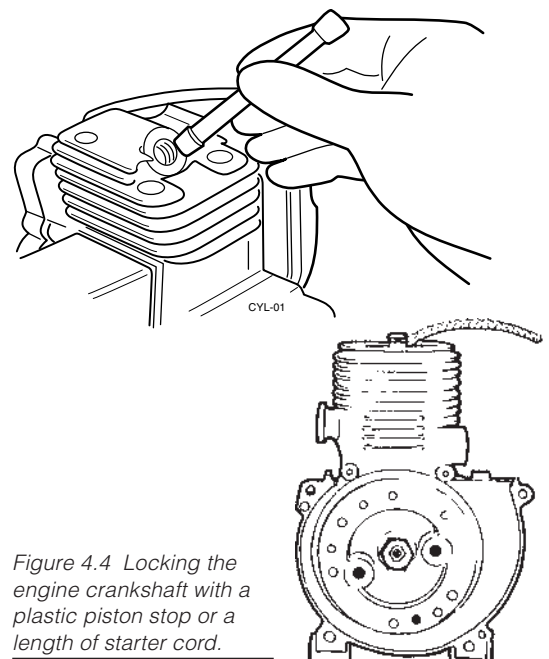


Figure 4.4 Locking the engine crankshaft with a plastic piston stop or a length of starter cord.

## Inspecting the Hub

- Inspect the hub for cracks, fractures, or other damage. Replace if noted.
- Inspect the pawl (where used) for wear at contact surfaces and attachment points. Replace if you detect damage or measurable wear.
- Inspect the pawl return spring. Replace if bent or otherwise distorted.

## Installing the Hub

**STEP 1.** Install the pawl (where used) in the reverse order of removal.

### IMPORTANT!

Pawl installation is designated “L” or “R” to permit engagement for counter-rotating engines! Starter pawls **must** be installed in the exact orientation as removed (Figure 4.5).

**STEP 2.** Install and tighten the hub assembly securely.

**STEP 3.** Install and tighten the hub retaining nut securely.

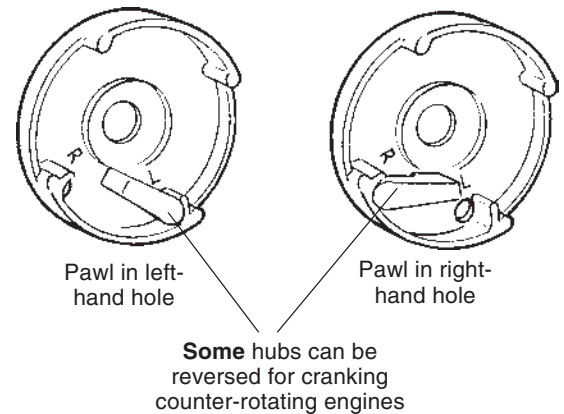


Figure 4.5 Starter pawl installation

## Cleaning and Inspecting (general)

Wash all parts (except the cord and handle) in clean solvent and blow dry.

- Inspect the starter cord for chafing, wear, or deterioration. Replace if noted.

### IMPORTANT!

Cord length and diameter are critical to both recoil spring life and overall starter performance! If Shindaiwa pre-cut replacement cord is not available, refer to the cord replacement chart for proper cord length and diameter!

- Inspect the rope guide (located in the recoil housing) for roughness or excessive wear. If such irregularities are noted, replace the housing assembly.
- **On engine**—inspect the hub, pawl, and pawl return spring. For hub-related service and repair procedures, see Hub Removal.
- Inspect the recoil spring for bends, cracks, or corrosion. Replace if noted.
- Inspect the recoil housing center post and spring retainer for excessive wear or cracks. Replace if noted.
- Inspect the recoil body and mounting lug areas for cracks or other damage. Replace if noted.

### CORD REPLACEMENT CHART

Model	Part Number	Length (in./mm)	Diameter (in./mm)
F/T-18	70064-75190	29.875/759	0.130/3
T/C/LE-230	70064-75190	29.875/759	0.130/3
F-20	70030-75160	33.25/845	0.130/3
F-21	70030-75160	33.25/845	0.130/3
T/C/LT-20	70030-75160	33.25/845	0.130/3
T/C-25	20000-75180	31.75/806	0.140/3.5
C-35	20000-75180	31.75/806	0.140/3.5
T/C-27	20024-75160	32.5/826	0.140/3.5
T/C/LE-250	20024-75160	32.5/826	0.140/3.5
BP-35	20020-75180	31.875/810	0.170/4
B-40	20020-75180	31.875/810	0.170/4
B-45	20020-75180	31.875/810	0.170/4
RC-45	20020-75180	31.875/810	0.170/4

### IMPORTANT!

Dimensions do not allow for compression (diameter) or stretch (length).

## Lubrication

Lubricate the recoil spring and recoil housing center post with a thin film of Shindaiwa Premium Gearcase Lubricant or equivalent.



## Reassembly (General)

### Recoil Spring (Cassette)

Carefully install a new Shindaiwa recoil cassette assembly in the starter housing.

### Recoil Spring (Retainer)

**STEP 1.** Grasp the spring with a needle-nose pliers and carefully remove and discard the outer retaining wire (new spring only: Figure 4.6).

**STEP 2.** Replace the spring in the reverse order of removal. Align the spring's outer end loop in the appropriate notch on the recoil housing or reel. Hold the spring in place while slowly releasing it with the pliers.

### NOTE:

If the spring escapes, it can be rewound inside the lid from a baby-food jar or similar small diameter appliance.

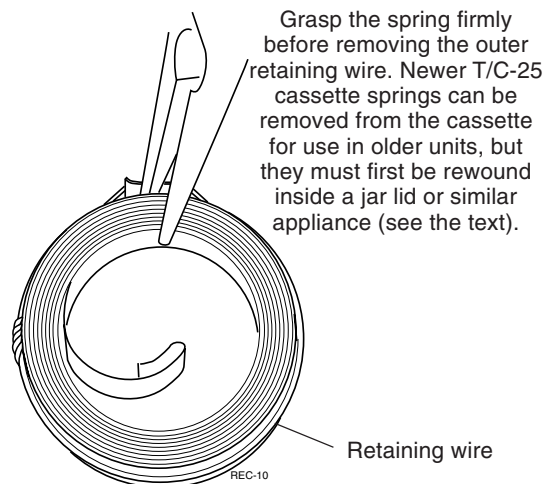
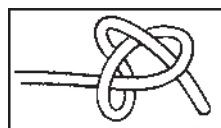


Figure 4.6 Grasping the recoil spring



Use a stopper knot to install the cord in the reel.

### Install the Cord

**STEP 1.** Replace the cord on the reel using a stopper-knot (Figure 4.7).

**STEP 2.** Wind the cord on the reel in the reverse order of removal, but leave the last 6 to 8 inches of cord exposed and hanging from the reel notch (Figure 4.8).

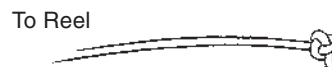


Figure 4.7 Stopper knot

### Install the Reel

**STEP 1.** Place the reel into the recoil housing. Replace the pawl actuating mechanism in the reverse order of disassembly. Install and tighten the center screw securely.

☛ For starter models with a metal recoil housing, apply LocTite™ or similar adhesive when making this installation.

### NOTE:

Units T/F-18 and T/C/LE-230 are assembled with a wave washer and retainer (Figure 4.1). When servicing these units, make sure these two components are oriented correctly on the recoil housing center post.

**STEP 2.** While holding the starter rope in the reel notch, wind the reel 2 to 3 turns.

■ Clockwise rotation for F-20

■ **All other units** wind in a counter-clockwise direction.

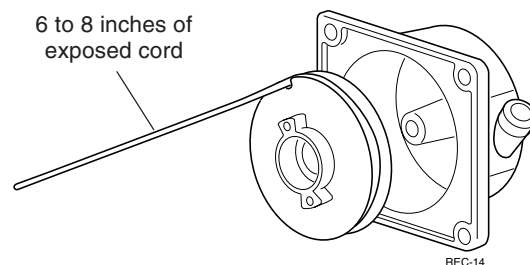


Figure 4.8 Installing the reel

## Replacing the Handle (general)

**STEP 1.** With 6 to 8 inches of starter cord still protruding from the reel notch, wind the reel 2 to 3 turns counter-clockwise (clockwise on F-20). See Figure 4.8.

**STEP 2.** While holding the reel in place with your thumb, thread the starter cord back through the notch and out through the rope guide.

**STEP 3.** Use a slip knot (Figure 4.2) to prevent the starter cord from rewinding, then thread on the handle and related components in the reverse order of removal. Place a stopper-knot at the end of the cord (Figure 4.9), remove the slip knot at the recoil housing, then allow the cord to rewind.

## Testing Spring Tension

**STEP 1.** While holding the recoil assembly with one hand, grasp the handle and pull the cord to its full length.

■ With the cord fully extended, you should still be able to rotate the reel at least 1/2 to 3/4 turn by hand.

■ If the spring appears too tight, remove the starter handle and reduce spring tension at the reel by one full turn.

**STEP 2.** Replace the handle as above, and then retest for proper tension.

### IMPORTANT!

A cord that fails to retract fully is usually the result of using bulk cord that has stretched or been cut too long. Shindaiwa starter cord has controlled stretch and is supplied in precut lengths, matched to specific models.

**STEP 3.** Install the recoil assembly on the power head. Coat the recoil mounting screws with LocTite™ or similar adhesive, and tighten securely.

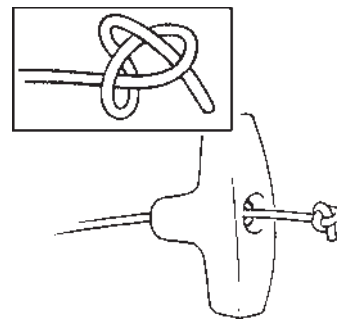


Figure 4.9 Installing the handle

## Assembling and Testing

To verify proper starter engagement and retraction, grasp the starter handle and pull the cord to its full length.

■ If the rope pulls freely but fails to engage, make sure the starter pawl and spring move freely. Also make sure the starter pawl and spring are properly oriented for your model trimmer or brushcutter.

■ If the the starter binds on either extension or retraction, verify correct line diameter.

■ Make sure all components are properly oriented beneath the starter post center screw.

## Section 5 Ignition Systems

### Theory of Operation

The TCI unit operates as a normally-closed grounding switch that allows current to flow within the magneto's primary coil windings whenever the engine's flywheel magnets approach the coil.

This current flow generates powerful electromagnetic flux lines that surround both the primary and secondary magneto coils (Figure 5.1).

The primary coil voltage driving this current flow peaks at approximately 200 volts as the magnets move past the coil.

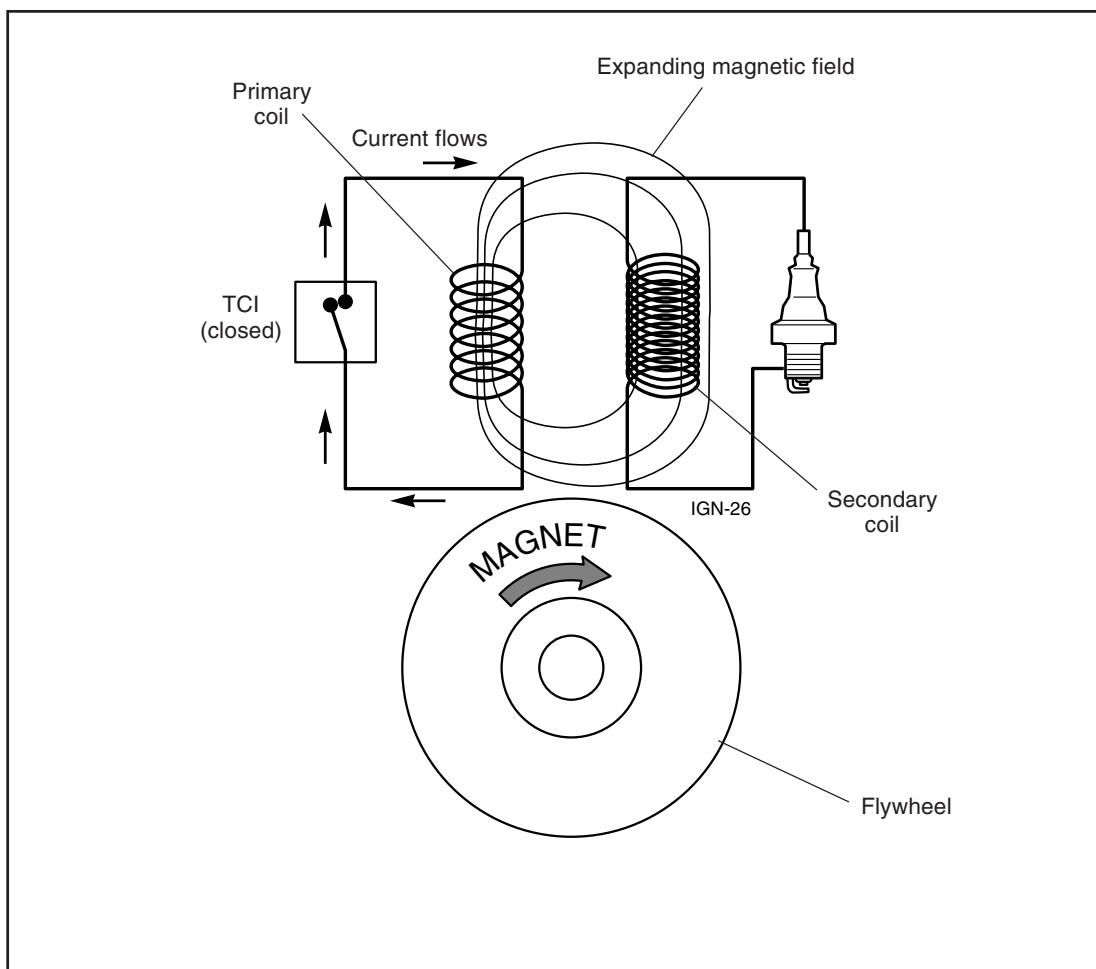


Figure 5.1 Acting as a switch, the normally-closed TCI allows the moving flywheel magnet to generate a flow of current in the primary coil. The current flowing in the primary windings generates a powerful magnetic field that surrounds both coils

Refer to Figure 5.2

The high-voltage surge causes the TCI to electronically switch "off" and interrupt the flow of current through the primary coil.

This sudden loss of current causes the magnetic field to collapse rapidly around both coils.

The moving magnetic field now causes the magneto's primary and secondary coils to function together as a powerful *transformer*, and primary coil voltages are multiplied by one hundred times or more within the secondary windings.

Secondary coil voltage continues to rise only until it reaches whatever voltage is required to bridge the spark plug gap and complete the circuit to ground.

Ignition shutdown is accomplished by physically grounding the magneto's primary coil with a mechanical on/off switch. The switch temporarily overrides the TCI unit, and any remaining system voltages are then too low to bridge the spark plug gap.

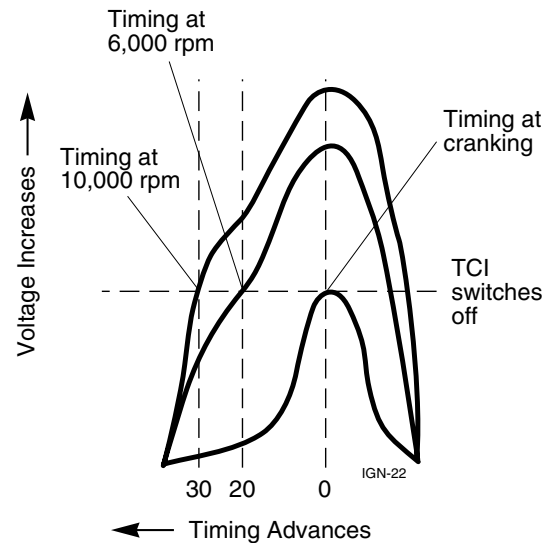


Figure 5.3 Spark timing is automatically controlled by changes in the shape of the primary coil's voltage wave-form, which in turn is determined by flywheel rpm.

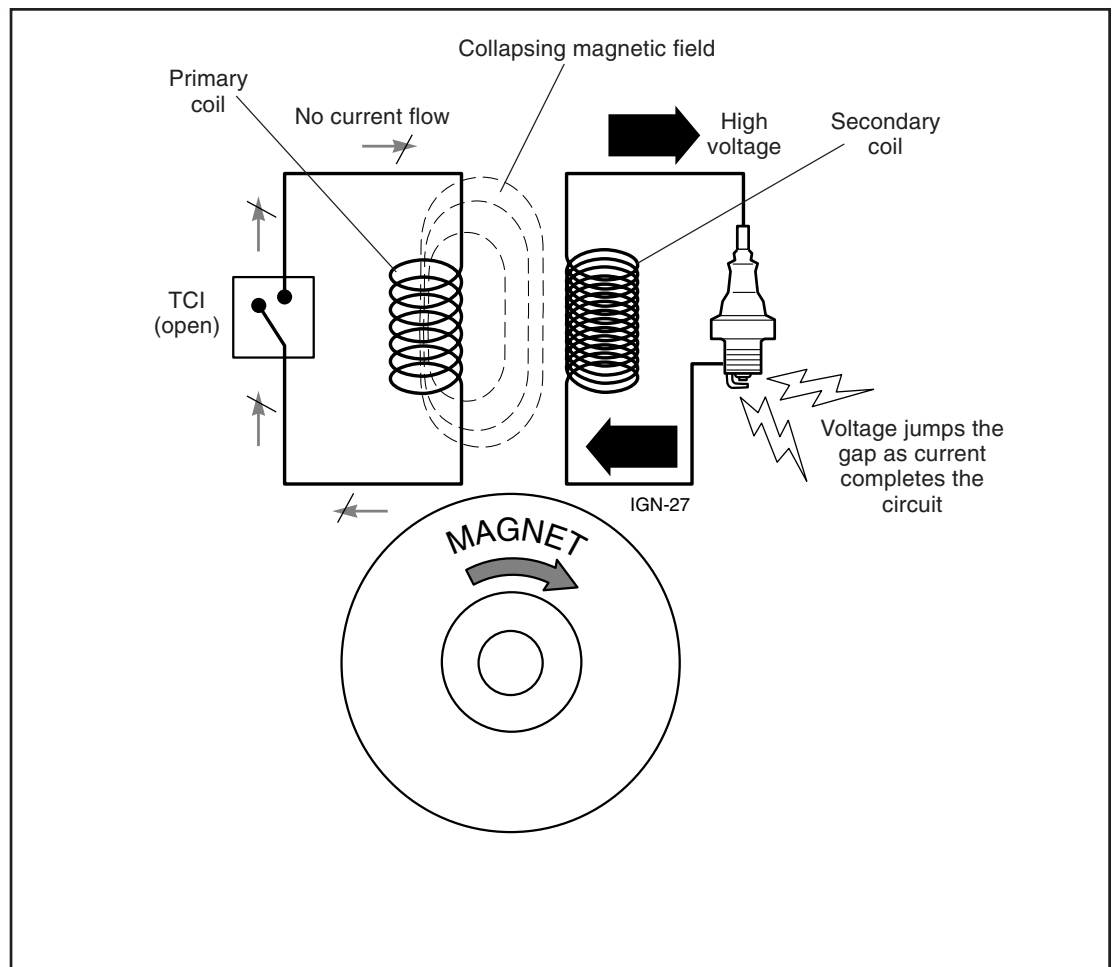


Figure 5.2 Rising primary voltage causes the TCI to abruptly switch off. The magnetic field collapses when the TCI switches off, and the moving magnetic field induces a high voltage in the secondary windings. Secondary voltage rises only until it can jump the spark plug gap and complete the circuit to ground.

## Section 5 Ignition Systems

### Construction

All Shindaiwa trimmers and brushcutters use a transistorized TCI ignition system powered by a flywheel-driven magneto (Figure 5.4).

Both initial timing and spark advance are controlled by the TCI unit, and a mechanical on/off switch or button is the only operator control provided.

Solid-state components within the TCI are protected from moisture and damage by an elastomeric potting compound. They are shielded either within a separate metal or plastic case, or are combined with the magneto to form a one-piece assembly.

Since wear-prone mechanical breaker points and rubbing blocks are eliminated, a TCI ignition will often outlast the equipment it's installed on.

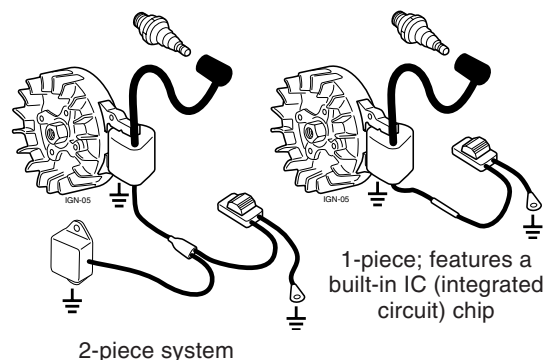
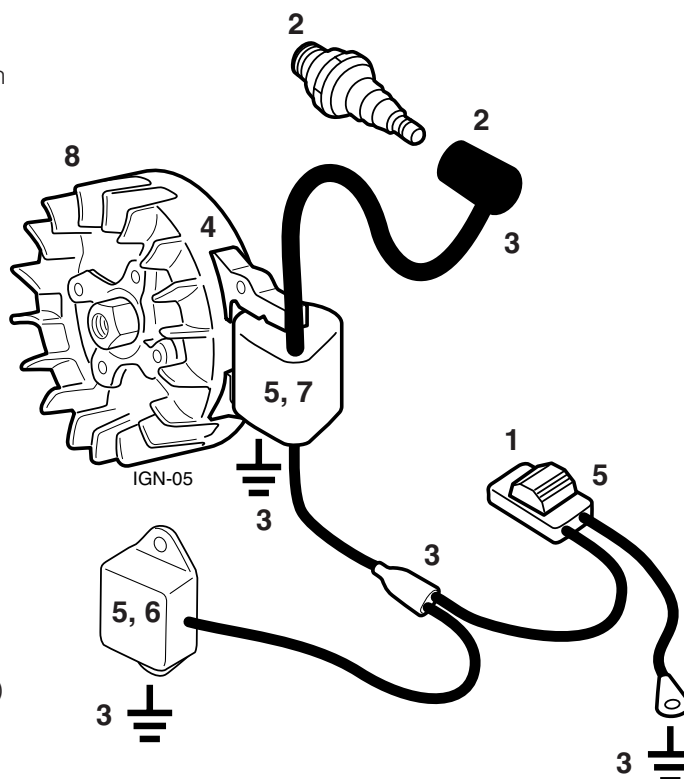


Figure 5.4 Shindaiwa TCI ignitions systems.

### Ignition Troubleshooting

1. Test the switch. A properly working switch passes current in the off position only.
2. Test high voltage output with a gap tester or kV meter. Check the spark plug for proper size and condition.
3. Clean and tighten all connections and grounds. Inspect for damaged wires or connectors.
4. Check the magneto air gap. Correct gap size: 0.012–0.014".
5. Check for correct parts and installation. Refer to the Illustrated Parts List (IPL). Make sure required insulators are properly installed under the magneto and/or TCI.
6. Test the TCI unit with a kV meter. Test the TCI (2-piece) by substitution.
7. Test the coil for open or shorted windings. Performance-test the coil with a kV meter or flywheel simulator.
8. Inspect for a sheared flywheel key (affects timing only).



The following pages of this Section provide additional details about these Troubleshooting steps.

Figure 5.5 Troubleshooting the electronic ignition system.

## Ignition Troubleshooting (continued)

### Equipment Requirements

Basic ignition troubleshooting requires an ohmmeter, an adjustable-gap spark tester (Figure 5.6), and a systematic approach to the problem.

#### IMPORTANT!

Most ignition troubleshooting can be completed in five-minutes or less, and can be performed without disassembling the trimmer!

☛ *Many ignition problems are the result of faulty or corroded wiring or ground connections. On an industry-wide basis, over 50% of all ignition components returned for warranty have nothing wrong with them!*

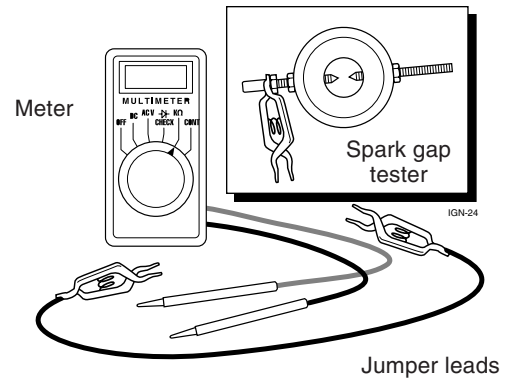


Figure 5.6 Basic Ignition Troubleshooting Equipment

### The Spark Plug

■ Remove the spark plug and inspect it for proper size, gap, and condition.

Spark plug condition is critical to the performance of any ignition system.

A plug with a worn, fouled, or improperly gapped electrode requires a higher firing voltage and may “cut out” under load when its required firing voltage approaches the maximum voltage available from the ignition system (Figure 5.7).

All current-model Shindaiwa trimmers and brushcutters are rated for a Champion CJ8-series spark plug gapped to .024” (0.6 mm), **Always check proper plug size and gap in the appropriate owner’s manual or in Shindaiwa publication 50537-0.**



#### CAUTION!

Spark plug heat range and dimensions are critical to the performance and lifespan of any gasoline engine! Always make sure the correct plug is installed and properly gapped! Installing a spark plug with a lower heat range than specified may cause excessive carbon buildup from incomplete combustion. Installing a plug with a higher heat range than specified may cause pre-ignition, and can shorten engine life significantly!

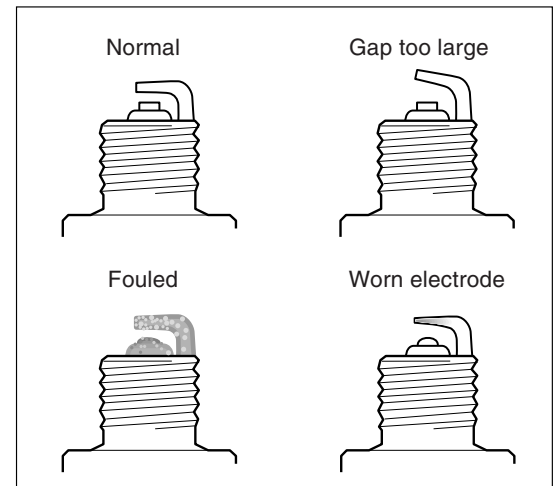


Figure 5.7 Spark plug troubleshooting. A plug with a worn, fouled, or improperly gapped electrode requires a higher firing voltage, and may not fire under heavy loads.

## Ignition Troubleshooting (continued)

### STEP 1. Test spark with an adjustable gap tester.

Install an adjustable gap tester, turn the ignition switch to the "run" position, and crank the engine vigorously (Figure 5.8).

☛ To simulate the higher voltage requirements of a spark plug firing under compression, test for spark at several settings out to gap of approximately 1/4".

- If a previously "dead" ignition now produces a strong bluish spark at the tester, the trimmer's spark plug is internally shorted and should be replaced.
- If there is no spark at the tester, or if the spark is weak, yellow-orange in color or seems to fire only occasionally, go to Step 2.

### STEP 2. Inspect the entire ignition system.

- Check for broken, corroded or damaged wires or connections.
- Make sure all ignition components are correct and installed properly. Use the appropriate Illustrated Parts List as a reference.
- Make sure the ignition stop switch is in the "on" position, or disconnect the switch as shown in Figure 5.9.

### STEP 3. Test the ignition "stop" switch.

(Figures 5.9 and 5.10).

If not previously disconnected, unplug the stop switch and retest for spark as in Step 1.

- If a spark now appears with the switch disconnected, use the ohmmeter (set to "low ohms") to test the stop switch for internal grounding. For an engine to run, the stop switch **must** show an "open circuit" (no meter movement) when in the "run" position.

### STEP 4. Test all ground connections.

Individually loosen and tighten the appropriate component mounting screws or fastenings, then retest for spark as in Step 2.

- If a steady blue spark now appears with each rotation of the flywheel, remove and clean all metal-to-metal grounding connections.

☛ Actual current flow is very low within a TCI system and can easily be blocked by small accumulations of dirt or corrosion.

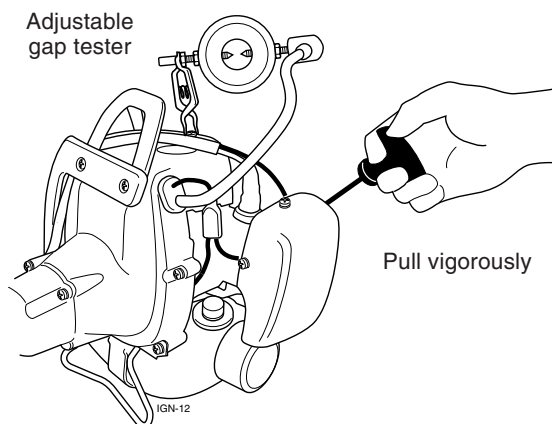


Figure 5.8 Testing with an adjustable gap tester

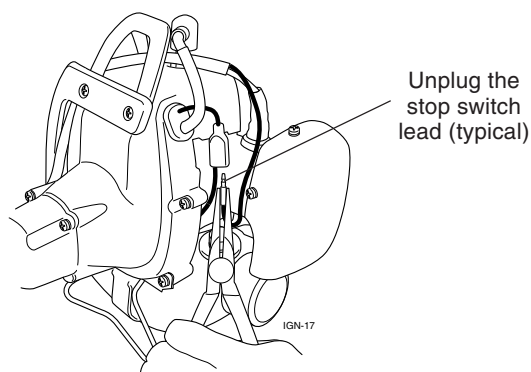


Figure 5.9 Disconnecting the stop switch.

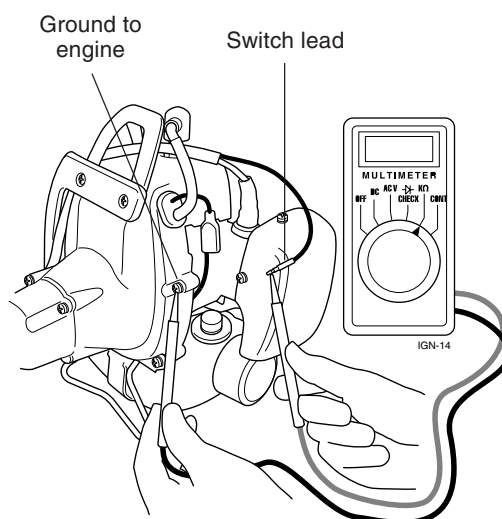


Figure 5.10 Testing the stop switch with an ohmmeter.



## STEP 5. Check magneto air gap.

(Figure 5.11).

Make sure the magneto air gap is set to the specifications listed in tune-up chart in the Appendix.



### CAUTION!

Electronic components can be easily damaged by operating the unit at excessive temperatures! When specified in the IPL, protective insulators (Figure 5.12) are essential to ignition component life and must NEVER be removed!

## STEP 6. Test ignition unit (two-piece ignition) by substitution. (Figure 5.13).

Unplug the unit at the harness, and temporarily connect a new unit. Retest for spark as in Step 2.

- If a spark now appears, the original TCI unit has an internal problem and must be replaced.

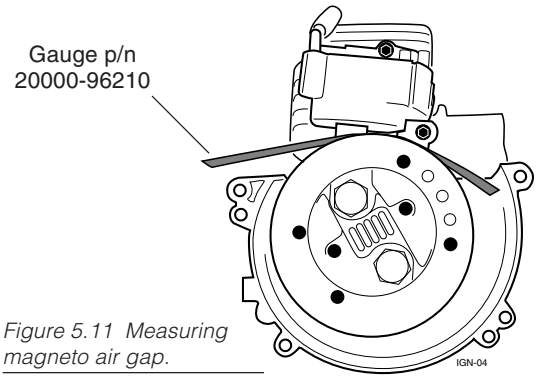


Figure 5.11 Measuring magneto air gap.

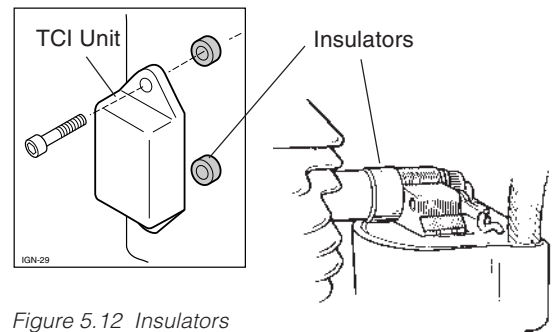


Figure 5.12 Insulators

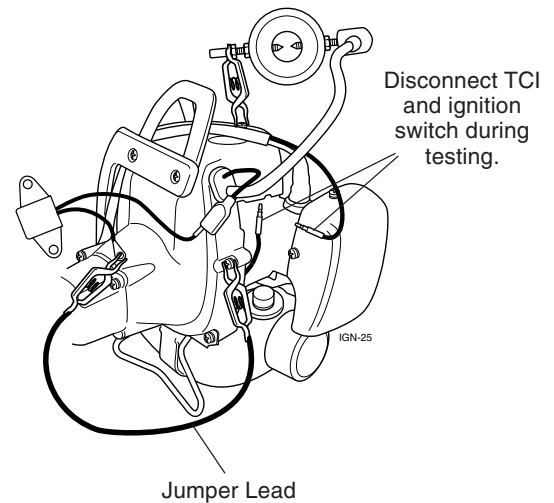


Figure 5.13 Testing the TCI unit by substitution (2-piece ignitions only).



## Section 5 Ignition Systems

### Ignition Troubleshooting (continued)

#### STEP 7. Test primary and secondary magneto windings (two-piece ignition) for continuity.

- Test primary coil resistance and compare with new parts (Figure 5.14).

- Test secondary coil resistance and compare with new parts (Figure 5.15).

An ohmmeter reading of either "0" or infinity (for "open circuit," and abbrev. "∞") during either test indicates the coil is internally faulted and must be replaced.

#### STEP 8. Test coil module (one-piece ignitions) secondary magneto windings for continuity as in Step 7.

- If the secondary coil resistance value appears normal, repeat Steps 3 and 4.

➤ *Internal connections between the primary windings and the integrated TCI make further ohms-testing impractical and unreliable. A modular coil that fails to spark after performing Steps 1–5 and 8 must be replaced.*

### Notes on the Use of Ignition Analyzers

Although not essential, an ignition analyzer can often save time and guesswork by visually displaying actual spark plug firing voltages and other performance data while an engine is operating under load.

Since analyzers vary in configuration and capability, only basic guidelines are provided here. For specifics on hookup and additional test procedures, consult the owner's manual for your particular analyzer.

### General Troubleshooting Procedures

#### Typical Equipment

A combination low-voltage and kV (kilovolt) high-voltage tester (Figure 5.16), a flywheel simulator, and the appropriate manual for the test equipment being used.

#### STEP 1. Test the available firing voltage between the high-tension lead and ground. (Figure 5.17).

➤ *Available firing voltage should be approximately 18 kV or more at normal cranking speed.*

- If the available voltage reading is at least 18 kV or above, go to Step 2.
- If available voltage is low, test for improper grounding or magneto air gap as in Steps 1 through 5 under Ignition Troubleshooting (previous section). If available firing voltage still tests low or reads "0," go to Step 2 (next page).

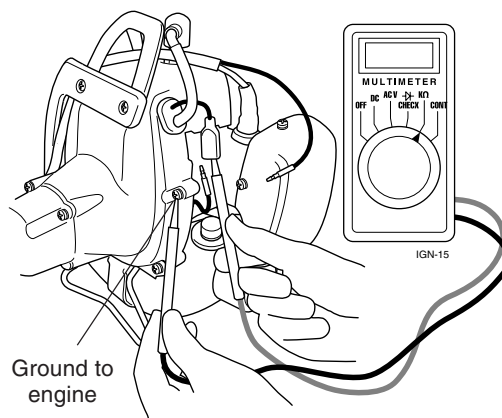


Figure 5.14 Testing the primary

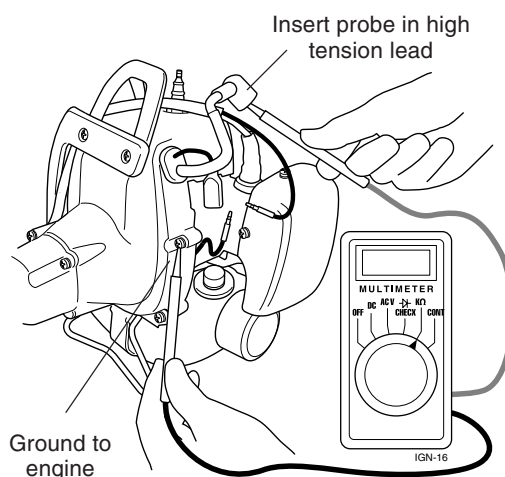


Figure 5.15 Testing the secondary

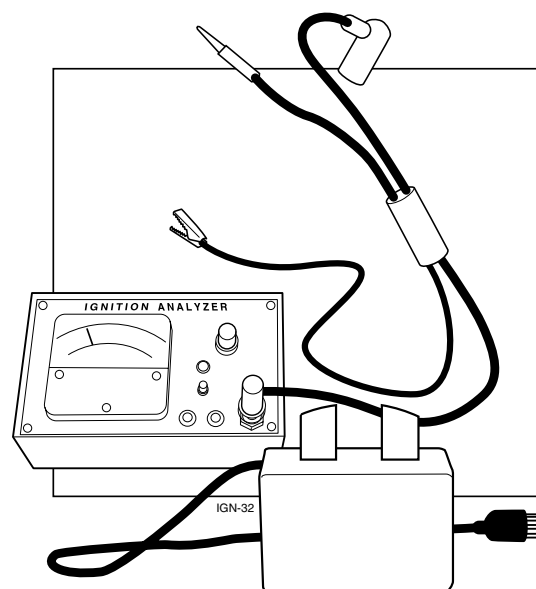


Figure 5.16 Analyzer and simulator (Imrie shown)

## STEP 2. Test the spark plug firing voltage between the coil high tension lead and the spark plug terminal. (Figure 5.18).

This test demonstrates the voltage required to fire the plug. The difference between required voltage and available voltage is referred to as *ignition reserve voltage*.

- If required voltage at cranking speed is more than 50% of available voltage, regap or replace the spark plug with a Champion CJ8 spark plug (or equivalent) set to .024" (0.6mm), and retest.

### IMPORTANT!

Available voltage must always be greater than required (firing) voltage, or the plug will misfire and fail under load! As a rule of thumb, required firing voltage generally increases about 1-kV for every .001" of additional plug gap. A high firing voltage indicates unusually high resistance within the spark plug, and increases the possibility of ignition failure under load!

## STEP 3. Measure primary coil voltage.

Disconnect the ignition stop switch and use the analyzer to measure voltage between the primary windings and ground.

➤ *Primary coil voltage at cranking speed should be approximately 120-volts or more.*

- If voltage is noticeably lower, check for proper air gap and ground connections (see Steps 1 and 5 under Ignition Troubleshooting).
- **Two-piece ignition** If primary voltage is still low, test the TCI unit by substitution (Step 6, Ignition Troubleshooting).
- **One-piece ignition** If primary voltage continues to read low after checking ground connections and air gap, replace the ignition coil.

When available, a flywheel simulator can be very useful for performance-testing individual ignition components or "basket case" ignition systems.

To duplicate the engine's moving flywheel magnets, the simulator generates a pulsating magnetic field that permits testing of individual components of any magneto-based ignition system (Figure 5.19).

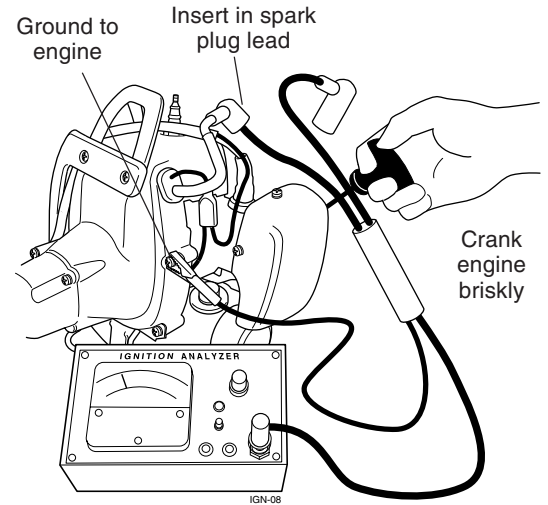


Figure 5.17 Available voltage at cranking speed should be at least 18 kV or higher.

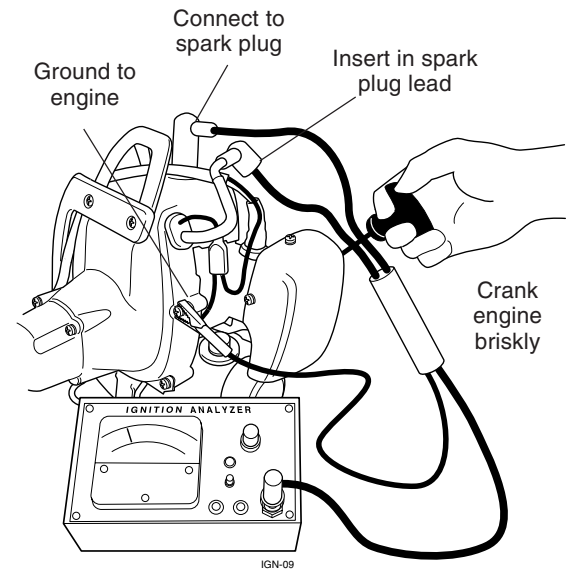


Figure 5.18 Testing voltage required to fire the plug.

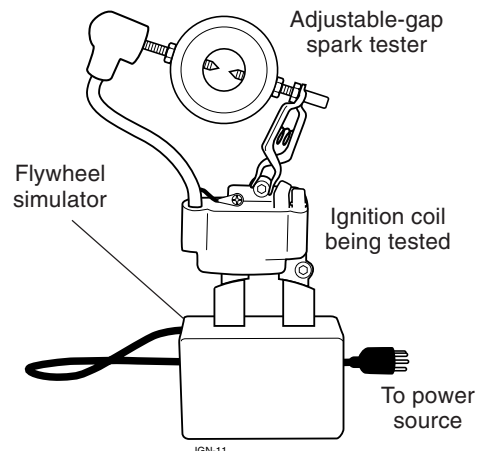


Figure 5.19 Using a flywheel Simulator

## Flywheel Simulator

# Section 6 Clutches and Flywheels

## General

All Shindaiwa trimmers and brushcutters use a centrifugal clutch mounted on the engine flywheel (rotor). Clutch shoe facing is either bonded or metal, and shoes are retracted by one or more coil springs hooked between the shoes.

As RPM increases, centrifugal force overcomes spring tension and forces the clutch shoes against the inner surface of the clutch drum (Figure 6.1).

The flywheel casting is indexed to the engine crankshaft by a machined woodruff key slot.

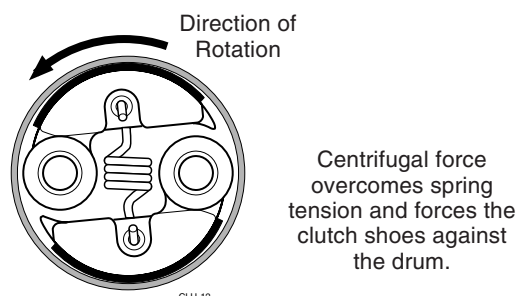


Figure 6.1 Typical clutch assembly

## Clutch Identification (Figure 6.2)

- Two-shoe clutches are used on all units up through the T/C-27 and BP-35.
- Three-shoe clutches are used on models C-35, B-45 and RC-45.
- Model B-40 and earlier models of C-35 were manufactured with a metal-shoe clutch with four shoes.

Although some clutch components are interchangeable between models, always verify that substitutions are identical in weight and dimensions to the parts being replaced.

Avoid random substitution of clutch springs—spring length, rate, gauge, and number of coils must all be accounted for.

Refer to the table at the bottom of the next page for clutch interchange information.

### IMPORTANT!

Part numbers are subject to revision! When ordering replacement parts, always consult the current IPL (Illustrated Parts List) and applicable Parts Revision Notices!



### CAUTION!

ALWAYS replace clutch shoes as an assembly! NEVER attempt to replace a single shoe or a portion of a set! Partial clutch replacement can cause trimmer vibration!

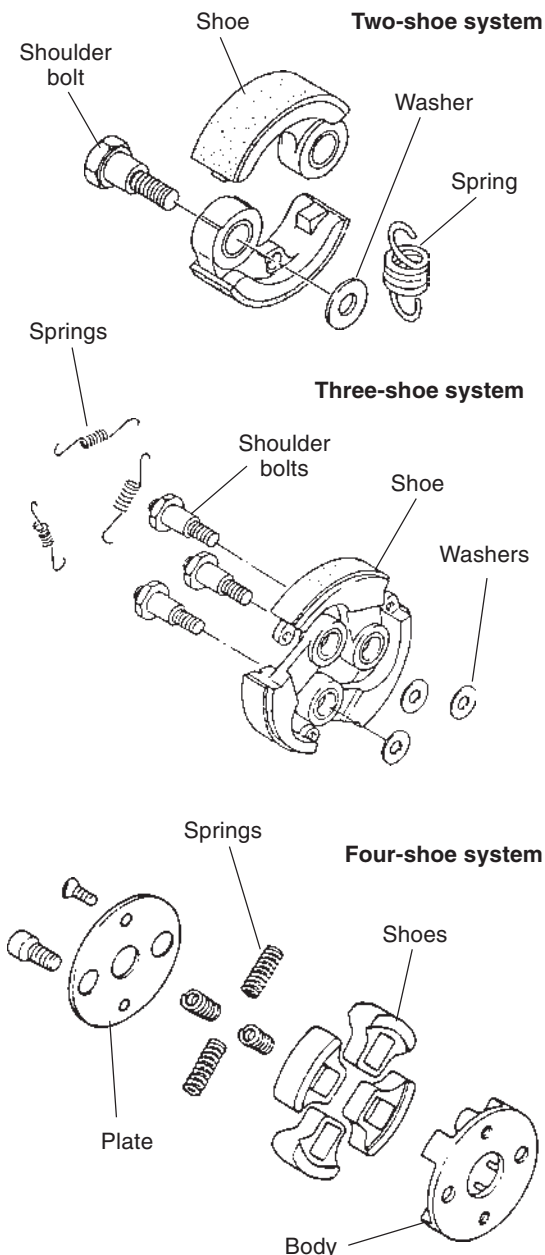


Figure 6.2 Clutch assemblies

## Clutch Shoe Orientation

Clutch shoe orientation determines whether initial clutch engagement occurs at the leading or the trailing portion of a clutch shoe's contact surface (Figure 6.3).

- A clutch installed in the leading position usually provides the fastest engagement with the least slippage at lower engine speeds, but may produce some slight "chatter" during initial engagement.
- A clutch installed in the trailing position allows slower (and therefore smoother) shoe engagement, but can be vulnerable to abusive low-rpm operation associated with excessive trimmer line length and some tree blades.

Shindaiwa trimmers and brushcutters will generally deliver best performance and longest clutch-shoe life when clutch shoes are installed in the factory-recommended orientation listed below.

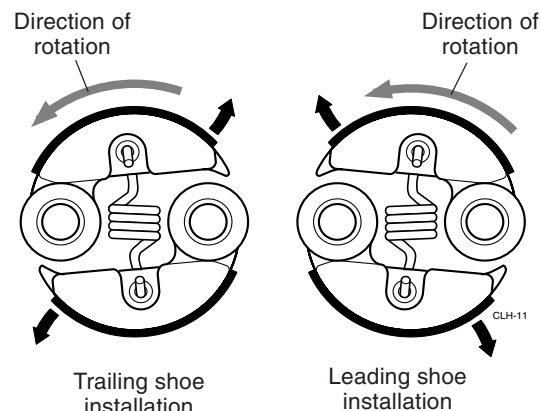


Figure 6.3 Shoe orientation determines both clutch engagement rate and performance.

## Clutch Removal (see Figure 6.2)

### Models With 2-Shoe Clutch

- STEP 1.** Lock the flywheel in position with clutch tool p/n 20000-96411 (Figure 6.4), or use a soft piston stop or short length of starter cord as shown in Figure 6.5.
- STEP 2.** Use a socket wrench to remove the two clutch shoe shoulder bolts. Note the position of the spacer washers between the clutch shoes and flywheel mounting bosses.

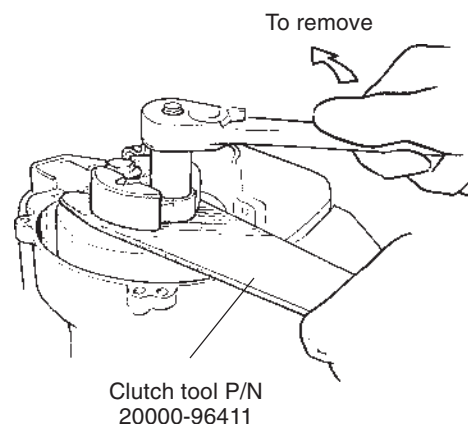


Figure 6.4 Using the clutch tool.

### Models With 3-Shoe Clutch

- STEP 1.** Use pliers to remove 3 clutch springs.
- STEP 2.** Use a soft piston stop or short length of starter cord to lock the flywheel in position (Figure 6.5).
- STEP 3.** Remove the clutch shoe shoulder bolts (same as 2-shoe).

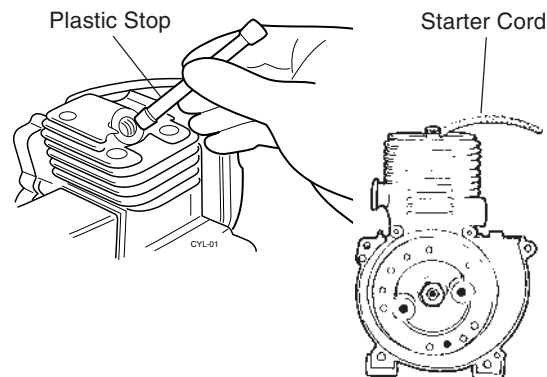


Figure 6.5 Two methods of locking the flywheel

### Clutch Assemblies by Model

Model	No. Shoes	Assembly P/N	Spring P/N	Model	No. Shoes	Assembly P/N	Spring P/N
F-18	2	70000-51103	70000-51220	T/C-27	2	20024-51100	20024-51220
T-18	2	20035-51100	20035-51221	C-35	2	20014-51100	20010-51120
F-20	2	70000-51103	70000-51220	C-35	3	20021-51100	20021-51120
F-21	2	70000-51103	70000-51220	C-35	4	20020-51100	20020-51131
T/C-20	2	20035-51000	20035-51221	BP-35	2	20050-51101	20050-51121
F/T/C-230	2	70140-51100	20035-51221	B-40	4	20020-51100	20020-51131
T/C-250	2	20018-51000	20018-51220	B-45	3	20021-51100	20021-51120
T/C-25	2	20000-51103	20000-51220	RC-45	3	20021-51110	20021-51120

# Section 6 Clutches and Flywheels

## Clutch Removal (continued)

### Models With 4-Shoe Clutch

**STEP 1.** Lock the engine flywheel.

**STEP 2.** Remove the two countersunk screws securing the cover plate using an impact driver fitted with a No. 2 phillips tip (Figure 6.6). Remove the cover plate.

**STEP 3.** Remove the two screws securing the clutch body to the flywheel using an allen wrench.

**STEP 4.** Remove the, springs and shoes from the clutch body (Figure 6.7).

## Inspection (General)

After disassembly, carefully inspect all components. Discard any assembly that shows signs of damage or excessive wear at:

- Clutch Shoe Contact Area
- Clutch Shoe Body (spring attachment point)
- Clutch Shoe Body (bolt pivot bore)
- Shoulder Bolt
- Spring (hook ends worn or broken, coils distorted)
- Clutch Mounting Boss (4-shoe clutch)



### CAUTION!

Always replace clutch shoes, springs, and shoulder bolts as a set. Never replace only one component.

## Assembly

Lightly lubricate the shoulder bolts and the clutch mounting boss faces with a thin film of lithium-based grease.

Reassembly is the reverse of disassembly. Torque the clutch shoe shoulder bolts to the specifications listed in the Appendix.

✦ **Clutch Service Note** For severe conditions, the 4-shoe clutch used on early models C-35 and B-40 can be installed on later models of C-35, B-45, and RC-45. The process involves tapping two 8 mm x 1.25 mm previously-untapped holes in the engine flywheel (Figure 6.8). Complete procedures are described in Shindaiwa Service Bulletin PR-115.

### NOTE:

A slight increase in vibration is common when running a unit using a 4-shoe clutch. Clutch chatter at idle speed is also common to the 4-shoe clutch and can usually be improved or eliminated by a slight adjustment to engine idle rpm.

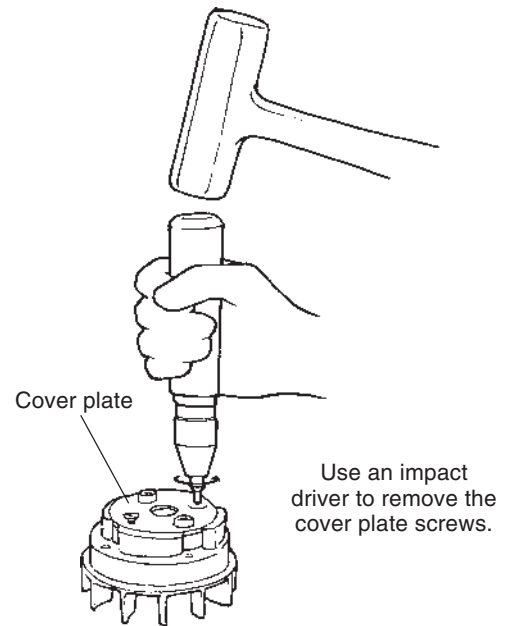


Figure 6.6 Removing the Cover plate.

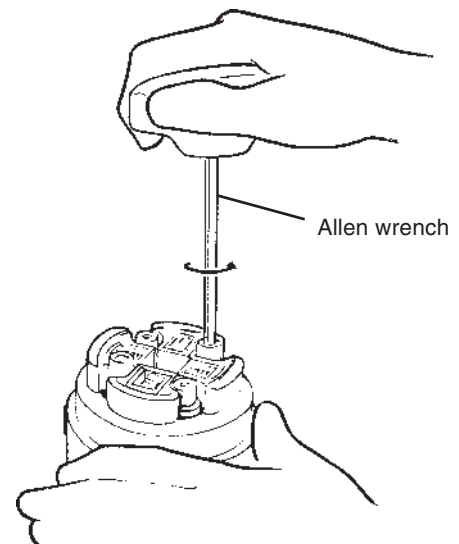


Figure 6.7 Removing the clutch body.

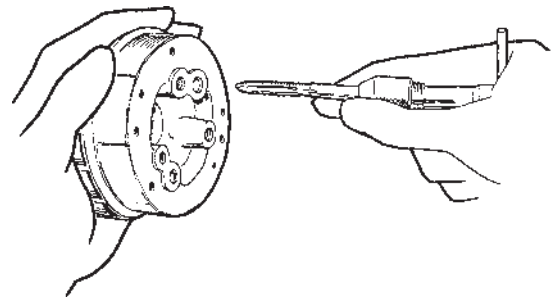


Figure 6.8 Tapping holes in the engine flywheel.

## Troubleshooting

Clutch performance and service life are directly related to operator habit.

- Prolonged low-speed operation may cause clutch shoes to “slip” (skid) against the clutch drum, producing friction that can quickly destroy clutch shoe facings.
- A slipping clutch is prone to “chatter”, causing rapid wear to clutch springs, bosses, and bolt holes (Figure 6.9).

For optimum performance and maximum clutch life, any Shindaiwa trimmer or brushcutter should always be operated at 65 to 70% of its rated maximum rpm range.



### CAUTION!

Trimmer engine speed is reduced as cutting line length increases! Excessive line length can cause clutch shoes to slip and is the leading cause of premature clutch failure!

Premature clutch failure can nearly always be traced one or more of the following:

- Low RPM operation at or near clutch-engagement speeds.
- Idle speed set too high. Recommended idle speed settings are provided in the Appendix.
- Sustained engine overload, resulting in low rpm operation.

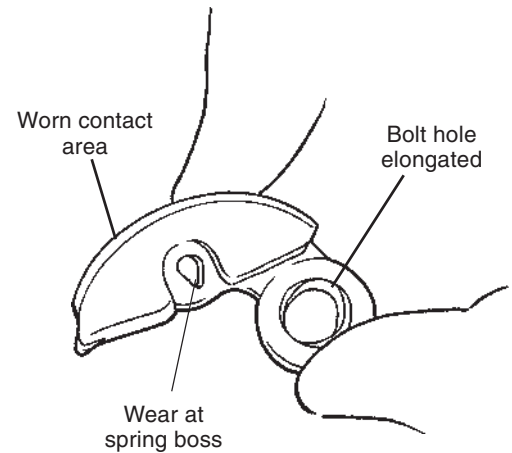


Figure 6.9 Inspect the clutch shoe assembly.



## Section 6 Clutches and Flywheels

### Servicing the Flywheel

**STEP 1.** Remove fan cover and related ducting as required. Remove the clutch shoe assembly as described previously in this section.

**STEP 2.** Lock the crankshaft and flywheel with an appropriate piston stop. Remove the flywheel nut (turn counterclock-wise).



#### CAUTION!

Do not use air, impact, or other power tools to remove flywheel nuts! Crankshafts can be permanently damaged by use of impact or other high-torque tools!

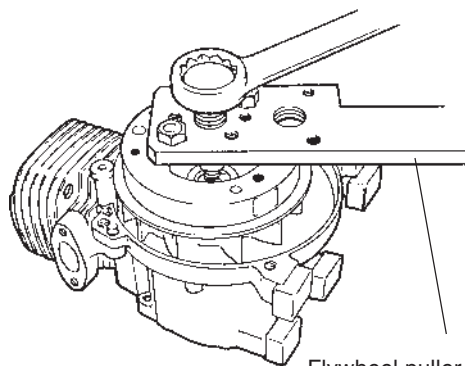
**STEP 3.** Use an appropriate puller to remove the flywheel from the crankshaft. Refer to the Special Tools Section of the Appendix (Figure 6.10).



#### CAUTION!

Never use striking tools to service flywheels! Use of hammers or other striking tools can damage the flywheel and may also distort the crankshaft!

**STEP 4.** Use diagonal pliers to remove the woodruff key from the crankshaft (Figure 6.11).



Flywheel puller (for the part number, refer to the Appendix, Section 12)

Figure 6.10 Removing the flywheel

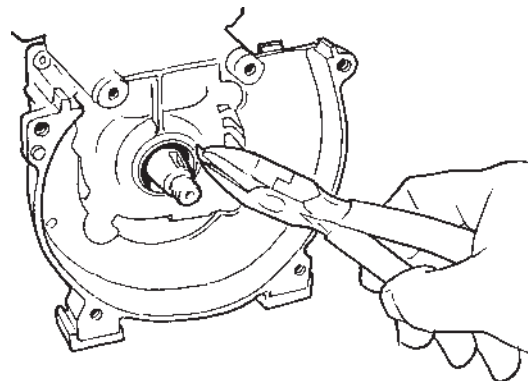


Figure 6.11 Removing the woodruff key with diagonal pliers.

## Inspection/ Cleaning

- Use a degreasing solvent to clean the crankshaft taper and the flywheel bore.
- Carefully inspect the woodruff key and the key slots on the crankshaft taper and the flywheel. Replace worn or damaged parts as required.
- Examine the flywheel casting, magnet, and insert (if fitted). If you discover any damaged or loose components, replace the flywheel as an assembly .

### NOTE:

Missing flywheel fins are often the result of operator abuse (sticks or other trash jamming in the flywheel), and can also indicate a bent or distorted crankshaft. If you suspect crankshaft damage, see inspection procedures described in Section 8.



### CAUTION!

Never attempt to reuse a flywheel that has damaged or missing fins! Flywheel fins are critical to both engine cooling and balance!

## Reassembly

**STEP 1.** Install woodruff key p/n 22100-43210 (same for all models) in the crankshaft keyslot.

**STEP 2.** Carefully fit the flywheel over the crankshaft and onto the woodruff key. Use a soft-faced hammer to firmly seat the flywheel on the crankshaft.



### CAUTION!

The flywheel must be installed "dry." Use no oil or other lubricants when assembling flywheel to the crankshaft!

**STEP 3.** Making sure the woodruff key is properly placed, install and torque the flywheel attachment nut to the specifications listed in the Appendix.

**STEP 4.** Rotate the flywheel by hand and make sure it turns true. Inspect and adjust the magneto air gap as described in Section 5.

**STEP 5.** Install the clutch assembly, fan cover, and ducting.



# Section 7 Cylinders and Pistons

## Construction

All Shindaiwa trimmer and brushcutter engines combine a two-ring piston running in a hard-chrome plated cylinder bore.

The second piston ring permits Shindaiwa engines to develop more power through better sealing while providing better piston support for longer product life.

The hard-chrome plated cylinder walls are electronically etched for oil retention, producing an extremely durable and long-lived bore.

All Shindaiwa trimmers and brushcutters use a thrust-control system at the small end of the conrod for better lubrication at high RPM and less wear to thrust surfaces (Figure 7.1).

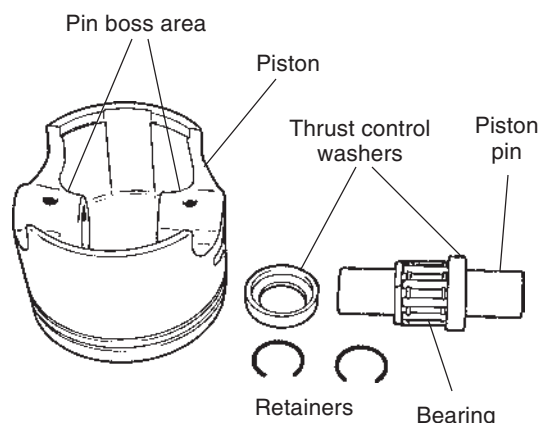


Figure 7.1 Piston and pin assembly.

## Cylinder Removal

**STEP 1.** Disconnect the high tension lead from the spark plug, and remove the fan cover housing (varies by model).

**STEP 2.** Disconnect the throttle cable and fuel lines. Remove the muffler as described in Section 9.

**STEP 3.** Remove the cylinder base screws (Figure 7.2), then carefully pull the cylinder from the piston and crankcase assembly.

Carefully examine the cylinder bore for any signs of scuffing, scoring, aluminum deposits, or visible wear.

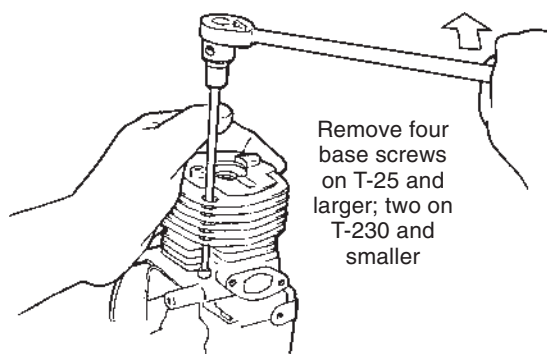


Figure 7.2 Removing cylinder base screws.



### CAUTION!

Do not rotate the cylinder on the piston! Rotating the cylinder may cause piston ring ends to catch and possibly break in the cylinder ports!

## Inspection

- If you discover cylinder bore wear, measure the bore with a micrometer and telescoping gauge (Figure 7.3). Replace any components distorted or worn beyond the tolerances listed in the Appendix .



### CAUTION!

Never install a used piston in a new cylinder! **Always** verify cylinder condition before reassembly! Never attempt to install a new piston in a used cylinder that is damaged, distorted, or is worn beyond specified tolerances!

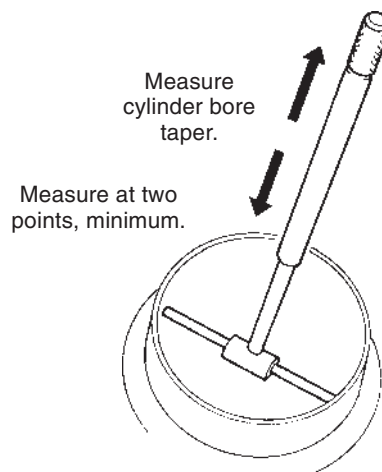


Figure 7.3 Measuring with an inside micrometer.

## Cleaning

### Decarbonizing

Examine the exhaust port and combustion chamber for signs of carbon buildup. Use a plastic or wooden scraper to remove carbon deposits.

#### IMPORTANT!

The cylinder **must** be removed from the engine and separated from the muffler for proper inspection or decarbonization!



#### CAUTION!

Never use metal tools, wire brushes, or abrasives to remove carbon deposits! Decarbonize cylinders with plastic or wooden tools **only**!

### Base Gasket

Use a sharp gasket scraper to remove hardened gasket material from the crankcase and cylinder base (Figure 7.4).

☛ *Baked-on gaskets can be softened quickly by applying a small amount of commercial paint remover first.*

If the base gasket is stuck to the crankcase, be very careful to avoid nicking or damaging the crankcase's aluminum sealing surface.

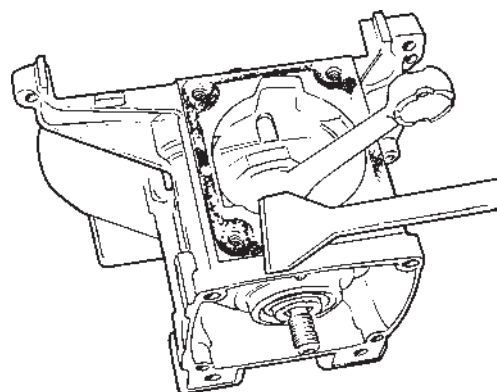


Figure 7.4 Use a gasket scraper to remove hardened gasket material.



#### CAUTION!

Sealing surfaces can easily be ruined by careless cleaning procedures! Scrape old gasket material with a conventional gasket scraper only! Never use a knife, file, or screwdriver to clean a sealing surface!

### Aluminum Deposits

Aluminum deposits that adhere to cylinder walls can be removed with muriatic acid, a commonly available concrete cleaner.



#### CAUTION!

Read and follow the acid manufacturer's use and safety instructions! Apply muriatic acid to chrome surfaces **only**! **Never** allow muriatic acid to contact aluminum engine components, as deterioration will be immediate!

☛ *Stubborn or glazed-over deposits may need to be sanded first with a small section of fine emery cloth.*

# Section 7 Cylinders and Pistons

## Piston Removal

Before removing the piston (all models), note the orientation of the arrow cast into the piston crown that is pointing towards the exhaust (muffler) side of the cylinder (Figure 7.5).



### CAUTION!

The arrow on the piston crown enables correct orientation of the piston ring end gaps within the cylinder and must **always** point toward the exhaust side of the cylinder. Improper piston installation can allow the piston rings to “hook” and fracture in the cylinder porting, resulting in major engine damage!

### Circlip Removal

Use a tapered pick to remove each circlip (Figure 7.6).



### WARNING!

Wear eye protection when working with circlips! Circlips are under spring tension and can be unpredictable during removal!



### CAUTION!

Never attempt to straighten or reuse a circlip! The circlip should lay flat and form a perfect circle. Always install new circlips during reassembly! **Never** attempt to substitute circlips from another engine make or model!

### Piston Pin Removal

Piston pins are press-fit. Avoid damaging or distorting the piston or crankshaft assembly during removal. Use one of two methods for removing a piston pin—

#### Piston Pin Removal Method 1

While supporting the piston with your hand (Figure 7.7), drive the pin out with the appropriate guide pin driver tool and a dead-blow hammer. Remove the thrust washers and bearing as the piston is removed.



### CAUTION!

Never attempt to remove a piston pin from an unsupported piston! Failure to properly support a piston during pin removal can cause damage to the piston as well as the crankshaft assembly.

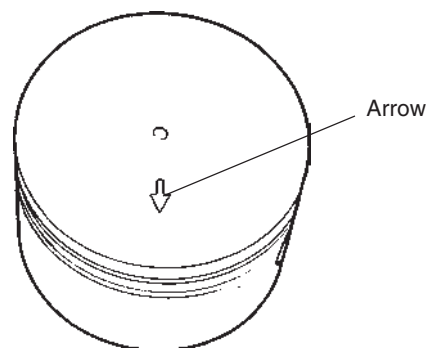


Figure 7.5 The cast-in arrow must always point toward the exhaust (muffler) side of the cylinder.

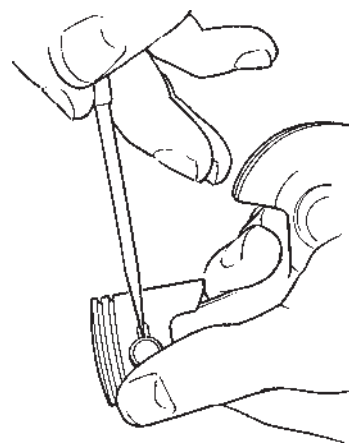


Figure 7.6 Using a tapered pick to remove a circlip.

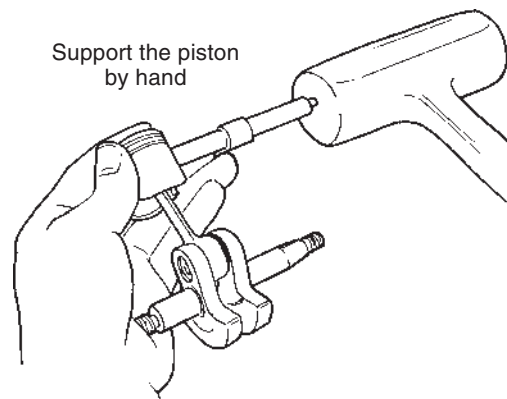


Figure 7.7 Removing the piston pin with a driver.

## Piston Pin Removal Method 2

Using pin removal tool p/n 72182-96300 and the appropriate push pin, press the pin from the piston (Figure 7.8). Remove the thrust washers and bearing as the pin is removed.

### IMPORTANT!

Avoid breaking the piston ring while using the pin removal tool! When installing the tool on the piston, make sure the piston ring end gaps are properly spaced over their appropriate locating pins on the piston (Figure 7.9)!

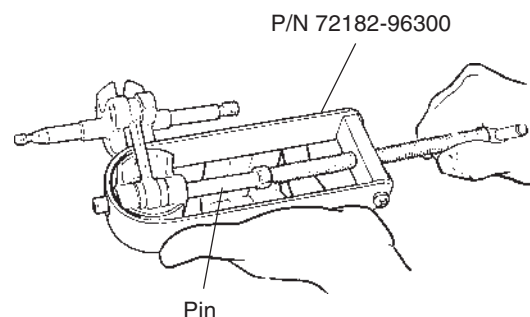


Figure 7.8 Removing a piston pin with a driver.

## Inspection

### Piston

Inspect the piston for wear, scuffing, scoring, operation with a loose piston pin, cracking, or other damage.

☛ *Be especially alert for damage caused by ingested water or debris. Carefully inspect for any damage or wear to the piston ring grooves or lands.*

Whenever a piston's overall condition is questionable, inspect and compare key wear areas with the specifications and tolerances listed in the Appendix.

### Rings

**STEP 1.** Using finger pressure alone, spread each piston ring only enough to permit the ring to just clear the piston crown.

■ Except for low-time engines or engines disassembled for reasons other than internal component failure, always replace both piston rings during teardown.

■ If piston rings are to be reused, carefully inspect them. Inspect ring edges for wear or rounding, and check ring ends for signs of cracking or chipping.

**STEP 2.** Measure piston ring thickness and width with a micrometer, and use a thickness gauge to measure piston ring end-gap with the individual rings installed about halfway into the cylinder bore (Figure 7.10).

☛ *Dimensions should be within the tolerances listed in the Appendix.*

### IMPORTANT!

If there is ever a doubt about the condition of either piston ring, replace both rings as a set.

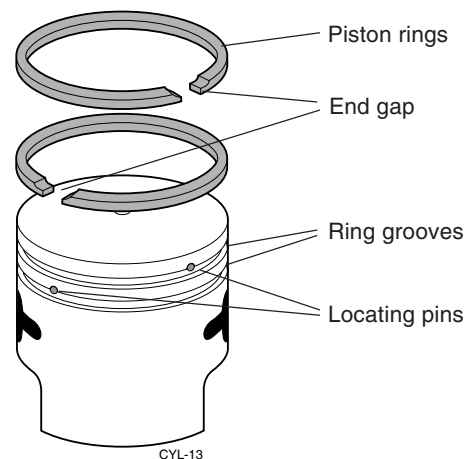


Figure 7.9 Piston ring end gaps must be spaced over the appropriate locating pins in the piston grooves.

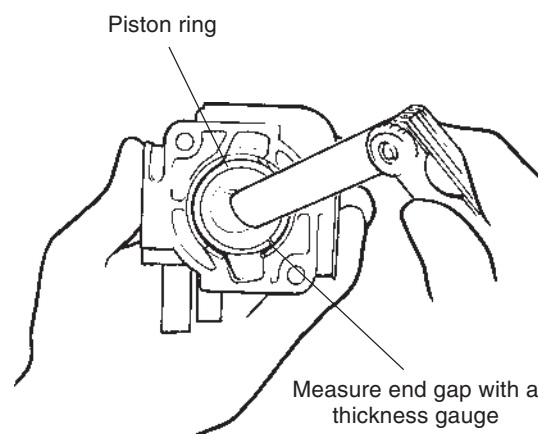


Figure 7.10 Measuring ring end gap

# Section 7 Cylinders and Pistons

## Inspection (continued)

### Thrust Washers

- If either thrust washer shows obvious signs of wear or discoloration from high-temperature operation, replace both washers as a set.

### Small-End (Pin) Bearing and Piston Pin

Inspect the bearing and pin for visible signs of wear. Also inspect for damage such as chipping, fractures, galling, or discoloration.

- If in doubt about the condition of either component, replace both parts as a set.

## Reassembly

### Piston/Crankshaft

The piston pin is press-fit into the piston and requires careful installation to avoid damaging or distorting the piston or crankshaft assembly. Two methods are suggested here:

### NOTE!

An assembly lubricant such as Never-Seize® can help minimize friction during the reassembly process. Uniformly heating the piston to no more than 100°C (212°F) will also assist this process.



### CAUTION!

After installing the piston on the crankshaft, make sure the arrow on the piston crown points toward the exhaust (muffler) side of the engine!

### Piston/Crankshaft Reassembly Method 1

Using an appropriate alignment tool, position the piston on the connecting rod with the needle bearing and thrust washers correctly oriented between the piston pin bosses (Figure 7.11).

Use a pin driver tool and a soft-faced hammer to drive the piston pin into the piston until it is centered between the two circlip slots.

### Piston/Crankshaft Reassembly Method 2

Use a suitable alignment pin to position the needle bearing and thrust washers as described above.

Using pin puller tool p/n 72182-96300 and a push pin, press the piston pin into the piston until it is centered between the two circlip slots.

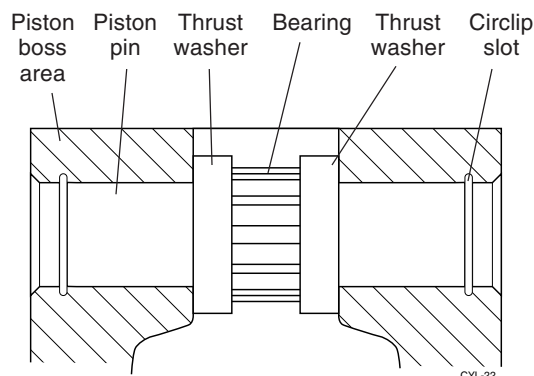


Figure 7.11 Thrust washer and bearing orientation.

✎ **Important Tip** To aid in properly centering the piston pin, preinstall one piston pin circlip opposite the driver tool, then tap the pin into the piston until it just contacts the clip. When centering the pin, be careful not to damage the circlip or circlip groove with the hammer.

## Piston/Crankshaft Reassembly Method 3

Install circlip(s) with their open ends facing either at the six o'clock (toward crankcase) or the twelve o'clock position (Figure 7.12).

When you hear an audible "click", the circlip is seated. To be sure, visually inspect the clips with a magnifying glass. As a final check, verify proper seating by using a pick to gently force the circlip into the groove.



### CAUTION!

Improper circlip positioning or installation can result in major engine failure!

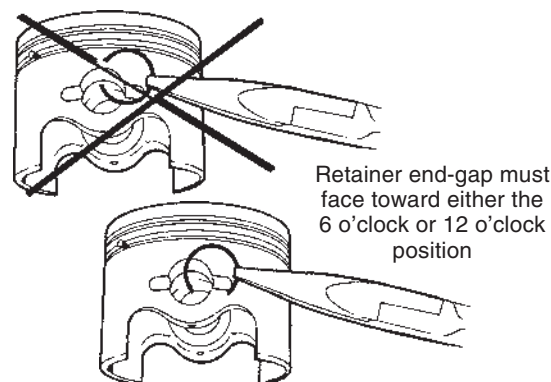


Figure 7.12 Retaining ring installation,

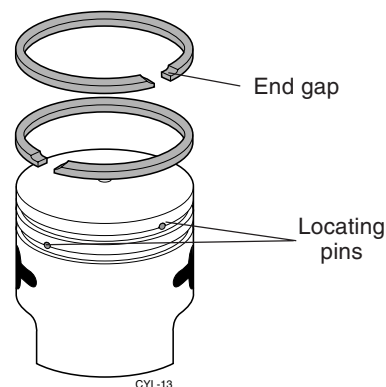


Figure 7.13 Locating ring end gaps.

## Cylinder Installation

Place a new base gasket on the crankcase assembly.



### CAUTION!

Never use sealant of any kind when installing the cylinder gasket! The cylinder base gasket must be installed **dry**!

Using hand pressure only, carefully install individual piston rings and align each with its appropriate locating pin (Figure 7.13).

Lightly lubricate both the piston assembly and cylinder walls with a suitable assembly lubricant.

## Piston Ring Installation

Using a ring compressor (Figure 7.14) or by compressing rings with finger pressure, carefully slide the cylinder over the piston.



### CAUTION!

Cylinders **must** be installed with the arrowhead on the piston crown facing the cylinder's exhaust port. Improper cylinder orientation or attempting to rotate the cylinder on the piston will cause piston rings to "hook" and fracture in the cylinder ports!

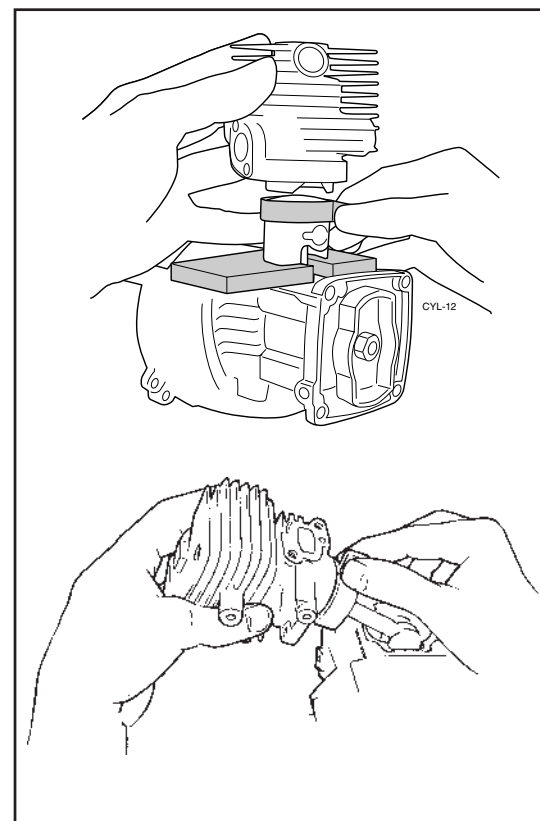


Figure 7.14 Compressing rings while installing pistons in the cylinder.

# Section 7 Cylinders and Pistons

## Cylinder Installation (continued)

### Install Cylinder Bolts

Coat the cylinder bolt threads with Three-Bond™ Liquid Screw Lock or equivalent, and tighten each bolt only until it just contacts the cylinder base, less about 1/2 to 3/4 turn.

### Cylinder Alignment

With one hand on the cylinder, center or "locate" the cylinder in the crankcase by slowly rotating the crankshaft while checking for binding (Figure 7.15).

When you find the proper cylinder location, hold the cylinder firmly while tightening the cylinder bolts in sequence.

### IMPORTANT!

Failure to properly locate the cylinder/crankcase assembly can result in lower overall performance, increased wear, high engine temperatures, and excessive stress on internal components.

### Torquing

Use a torque wrench (Figure 7.16) to torque the cylinder bolts to the specifications listed in the Appendix.

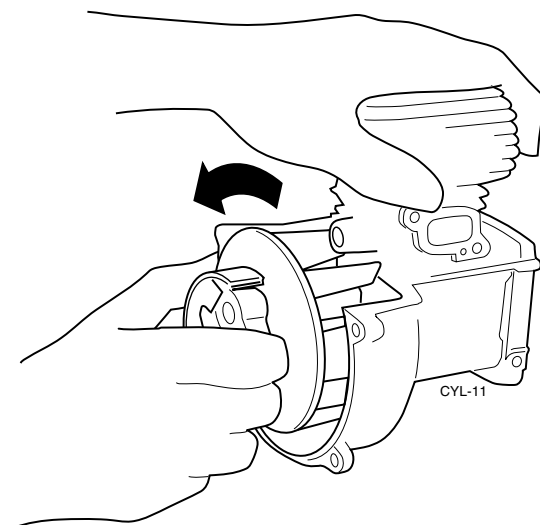


Figure 7.15 Center or 'locate' the cylinder in the crankcase.

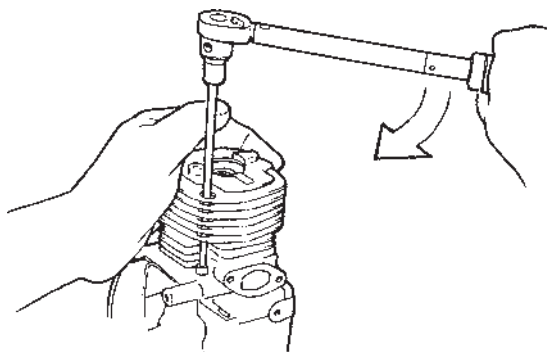


Figure 7.16 Torque cylinder retaining bolts to the specifications listed in the Appendix.

### Final Assembly

**STEP 1.** Install the muffler as described in Section 9.

**STEP 2.** Install carburetor and reconnect fuel lines and control cables as described in Section 3.

**STEP 3.** Install the cylinder cover, spark plug (if removed), and fit the high tension lead.

#### IMPORTANT!

A rebuilt engine can run slightly hotter than normal until new parts conform or “seat” against each other. This is caused by initial friction and temporary blow-by between new piston rings and cylinder walls.

Shindaiwa recommends that after any rebuild—

- the engine's carburetor be adjusted slightly rich.
- the engine be operated at varying speeds and reduced loads for approximately 10 hours.



# Section 8 Engine Crankcase

## Introduction

All Shindaiwa trimmer and brushcutter crankcases feature diecast aluminum alloy construction for longest service life and maximum durability (Figure 8.1).

Gasketless two-piece construction with machined mating surfaces is standard, and replacement crankcase halves are available as individual part numbers.

Crankshafts are supported by large ball bearings pressed into individual crankcase halves, and mate to clutch and flywheel assemblies via Woodruff keys installed in machined key slots.

### NOTE

Crankcase halves are identified by either an "M" or "S" following the part name:

**S** refers to the crankcase half located on the recoil-starter side of the engine.

**M** refers to the half used on the magneto (output) side of the engine.

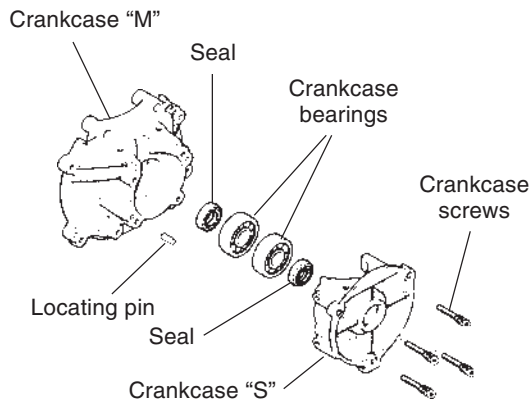


Figure 8.1 Typical Shindaiwa Crankcase Assembly

## Crankcase Disassembly

### Remove Accessories

**STEP 1.** Remove the cylinder cover and related shrouding. Remove the piston and cylinder as described in Section 7.

**STEP 2.** Remove the fan cover, clutch assembly, and flywheel as described in Section 6.

**STEP 3.** Remove the recoil assembly and starter pulley as described in Section 4.

**STEP 4.** Use diagonal pliers to remove the crankshaft woodruff key (Figure 8.2).

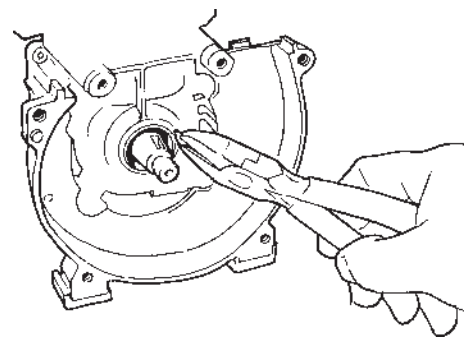


Figure 8.2 Removing the Woodruff key from the crankshaft.

### Separate the Crankcase

**STEP 1.** Use a 4 mm allen wrench to remove the 3 or 4 bolts securing the two crankcase halves (early model T/F-20 with phillips-head fasteners require a No. 2 tip).

**STEP 2.** While firmly holding crankcase half "S," gently tap crankcase half "M" with a soft-faced hammer (Figure 8.3).

**STEP 3.** As the crankcase halves begin to separate, gently tap the crankshaft from crankcase half "S."

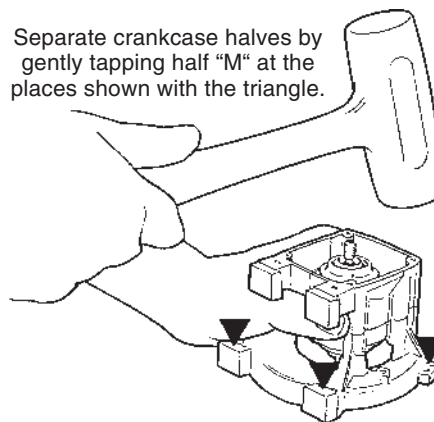


Figure 8.3 Tap crankcase halves with a hammer.



### CAUTION!

Never insert knife blades or other tools between the crankcase mating surfaces! A screwdriver may be used only where separation slots have been provided (Figure 8.4)!

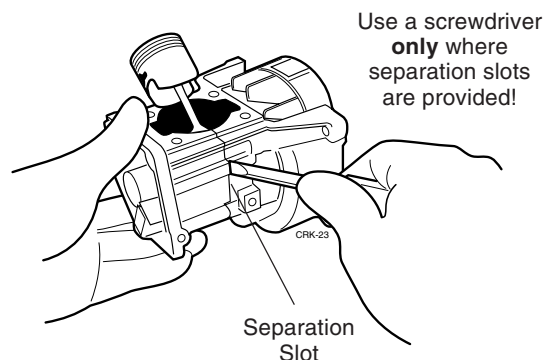


Figure 8.4 Separate halves at the separation slot only!

## Crankcase Inspection

Carefully inspect crankcase halves for cracks or other damage.

☛ *Carefully inspect crankcase mating surfaces and cylinder base surface for nicks, scratches, or other damage that might cause leakage or misalignment during operation.*



### CAUTION!

Make sure the crankcase locating pins are correctly press-fit into crankcase half "M" (Figure 8.5).

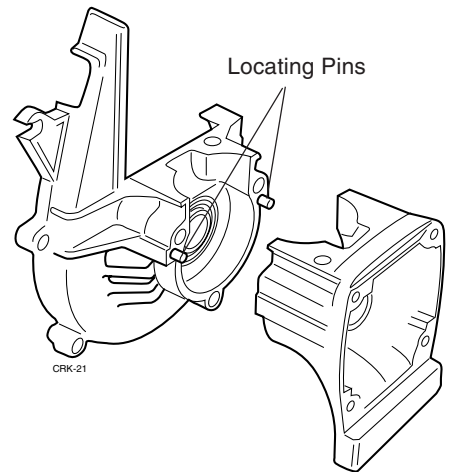


Figure 8.5 Check crankcase locating pins.

## Removing Crankcase Seals

### ■ With the Crankshaft Removed

Pry the seals from the crankcase halves using either a hook-type seal remover or a screw-driver blade (Figure 8.6).



### CAUTION!

Avoid scratching or nicking the crankcase seal bore!

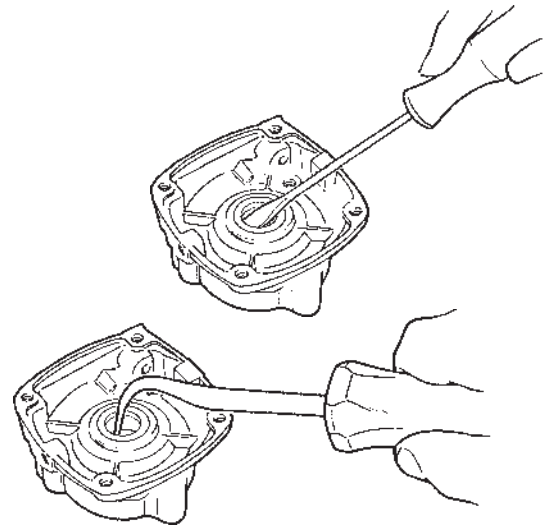


Figure 8.6 Removing crankcase seals.

### ■ With the Crankshaft In Place

If a seal puller will slide over the crankshaft, remove the seals with a threaded screw-type puller such as Shindaiwa p/n 22150-96600 Seal Puller (Figure 8.7).

or

Punch a small hole through the seal's metal shell and withdraw the seal with a slide-hammer puller.



### CAUTION!

Never drill through a seal shell! Chips or other drilling debris may lodge in crankshaft bearings and lead to early bearing failure! Never allow puller tips or other tools to contact the crankshaft bearings!

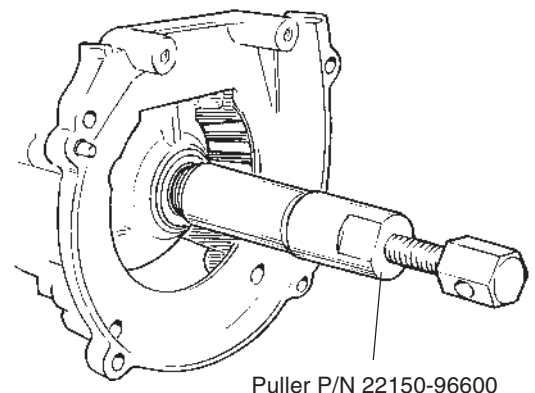


Figure 8.7 Removing seal with a seal puller.

## Section 8 Engine Crankcase

### Bearing Inspection

Inspect both crankshaft bearings for damage or accumulated debris (Figure 8.8).

☛ *Carefully spin each bearing by hand. Replace any bearing that feels "rough" or "hangs up" while being rotated.*

#### NOTE

Removing bearings for inspection is generally not necessary unless the powerhead has suffered a major internal failure or has ingested large amounts of debris.

If a bearing must be removed, always replace it with a new one. Shindaiwa recommends that any replacement bearing be either the factory recommended part, or a bearing of equivalent quality and fit from the same manufacturer.



Normal bearing

Dirt or accumulated debris: Replace

Missing and/or damaged components: Replace

Figure 8.8 Inspect bearings visually and manually

**Shindaiwa engines are high-performance engines and require premium bearings for maximum performance and service life.**

### Bearing Removal

**STEP 1.** Place the crankcase half face down on a clean wooden surface drilled to accommodate the crankcase locating pins.

**STEP 2.** Remove the bearings from each of the two crankcase halves using the appropriate bearing driver and a heavy hammer (Figure 8.9).

☛ *If bearings are difficult to remove, the crankcase bearing bore can be expanded slightly by using a heat gun to heat the bearing boss area to approximately 100°C (212°F). See Figure 8.10.*

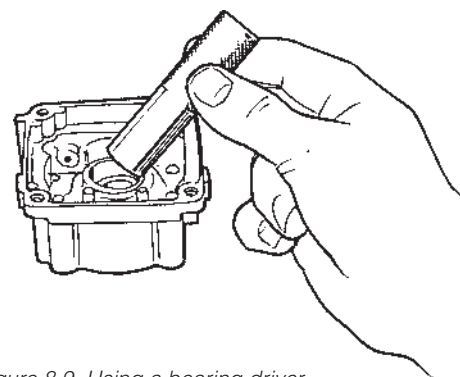


Figure 8.9 Using a bearing driver

### Cleaning

Carefully clean all mating and sealing surfaces (Figure 8.11).

☛ *Use acetone or a commercial gasket compound solvent to remove dried gasket compound deposits and to clean bearing bores.*

Paper-gasket residue can usually be softened with paint remover. When using a scraper or other edged tool, be extremely careful not to nick or scratch crankcase sealing surfaces.



#### CAUTION!

Do not allow acetone or paint remover to contact your skin! Always wear gloves when working with solvents! Always follow solvent manufacturer's directions and cautions for proper use, cleanup, and disposal!

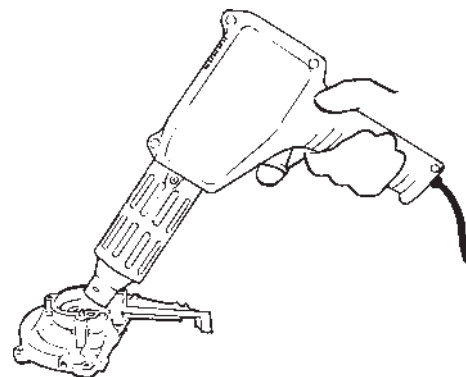


Figure 8.10 A heat gun can simplify bearing removal.

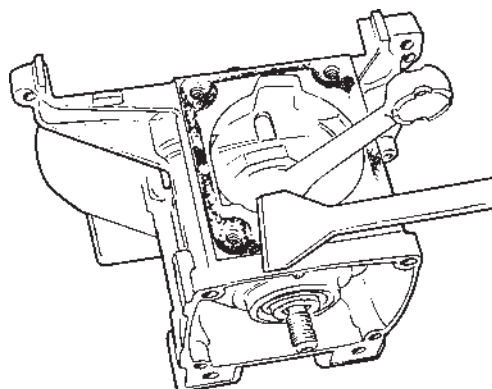


Figure 8.11 Use a gasket scraper to remove hardened gasket material.

## Bearing Installation

Bearing installation is easiest if the crankcase bearing bore is first expanded slightly with a heat gun as shown in Figure 8.10.

**STEP 1.** Drive the bearing into the crankcase using the appropriate bearing driver and a dead-blow mallet, until the bearing contacts the base of the bearing bore (Figure 8.12).

**STEP 2.** Spin the installed bearing to test for roughness or excessive drag. Replace if necessary.

### NOTE

Avoid excessive hammering. Avoid using a heavy steel hammer when driving bearings. Doing so can cause bearing rebound, resulting in an improperly seated bearing.

Drive the bearing only until it contacts the base of the bearing bore. **Do not use excessive force!** If available, use an arbor press to provide a much-improved “feel” during bearing installation (Figure 8.13).

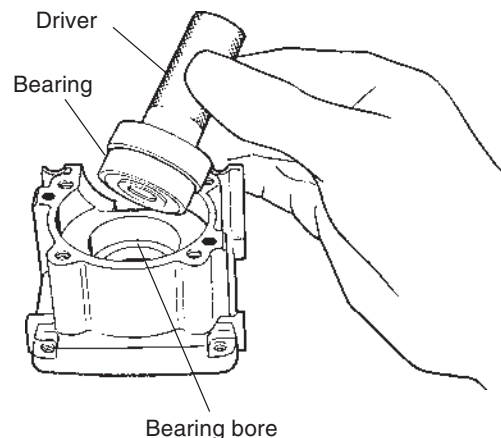


Figure 8.12 Installing a bearing with a driver.

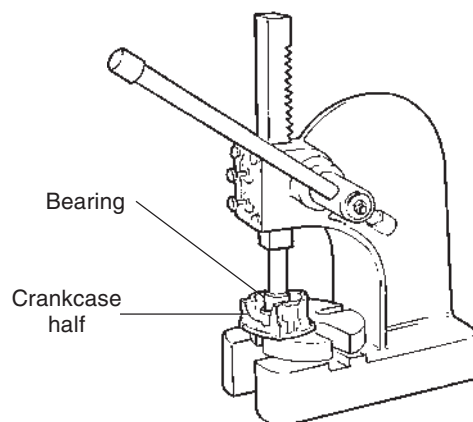


Figure 8.13 Installing bearings with an arbor press.

## Seal Installation



### CAUTION!

Seal integrity is vital to engine performance and longevity! Always replace both crankcase seals during major engine overhaul! Always pressure-test the assembled engine after replacing seals and bearings. Refer to Section 2.

### STEP 1. Apply grease

Prior to installing either seal, apply a small amount of grease both around and behind the seal's neoprene lip (Figure 8.14).

➤ A seal with a rubberized outer coating requires no further attention, but an uncoated metal seal O.D. should receive a thin coating of Three-Bond® #1304 or equivalent prior to installation.

### STEP 2. Drive In the new seal

Drive the new seal flush with the outer face of the seal bore using the appropriate seal driver and a plastic or dead-blow hammer (Figure 8.15).

➤ Carefully inspect the completed installation. A seal that contacts the inner bearing race or is bent or damaged in any way must be replaced.

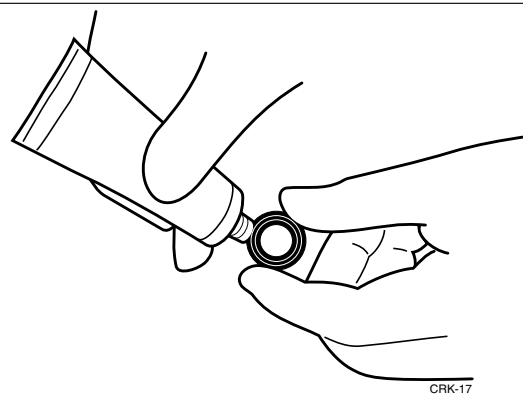


Figure 8.14 Pre-lube seals prior to installation.

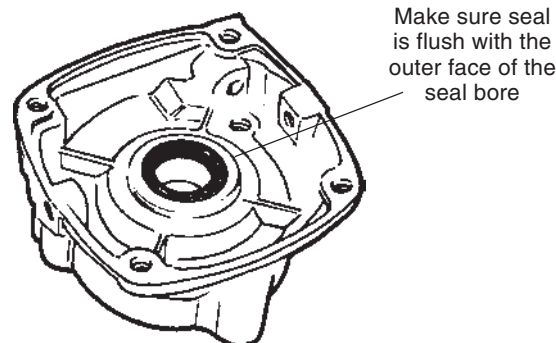


Figure 8.15 Seal in the crankcase bore.

## Section 8 Engine Crankcase

### Crankshaft Inspection (Figure 8.16)

Carefully inspect the crankshaft before reassembly, especially if the engine suffered a major component failure or sudden stoppage.

A crankshaft assembly that fails in any of the following areas should be replaced.

#### ■ Crankshaft bearing seal contact surfaces

Inspect for wear or burnishing at both crankshaft bearing and seal contact surfaces. Wear must not exceed the tolerances listed in the Appendix.

#### ■ Connecting rod big-end bearing

1. Check for signs of roughness or irregularity within the big-end bearing by rotating the rod slowly around the crankshaft.
2. Slide the connecting rod from side-to-side and note any excessive drag. inspect both the needle bearings and cage for damage.

#### NOTE.

A damaged crankpin can cause “ratcheting” when the rod is moved across the crankshaft. Such damage often results from the hammering effects of detonation caused by operating the engine on low octane gasoline.

#### ■ Connecting rod small-end bore

Inspect for signs of excess heat, including bluing or stress cracking.

#### ■ Connecting rod

Inspect the connecting rod for signs of bending. If you suspect bending and/or the piston shows signs of irregular wear, replace the crankshaft assembly.

#### ■ Woodruff key slot and crankshaft taper

Check for cracking or chipping at the woodruff key slot. Also check for damage at the crankshaft taper.

#### ■ Threaded ends

Inspect both threaded ends for stripping, cross-threading, or other damage. Replace if damaged beyond repair.

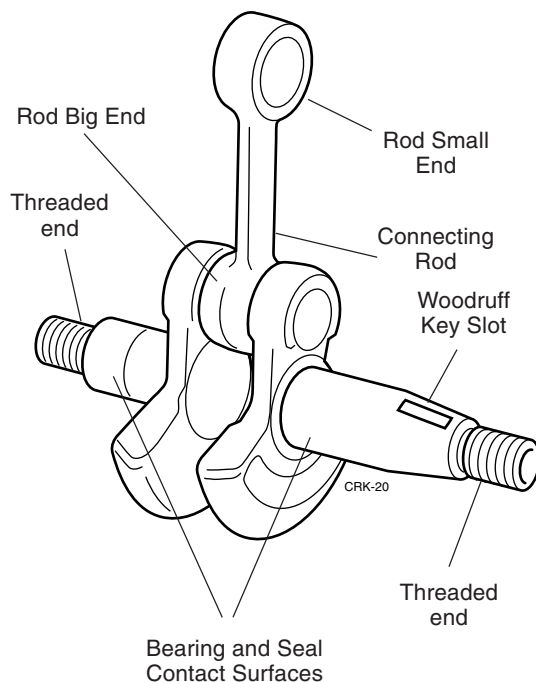


Figure 8.16 Crankshaft assembly inspection points.

## ■ Twist

A three-piece crankshaft assembly can become twisted from a severe inertial impact such as a sudden stoppage from a broken piston or excessive use of an impact gun during routine service.

☛ A twisted crankshaft will often reveal itself to a user by uneven or difficult cranking, leaking crankshaft seals, or loose crankshaft bearings. A severely twisted crankshaft may even display a visible wobble or “run out” when the flywheel is slowly rotated.

The preferred and most accurate method of checking for crankshaft run-out requires mounting the crankshaft between centers and measuring runout with a dial indicator (Figure 8.18).

A crankshaft with runout exceeding the specifications in the Appendix must be replaced.

If a dial indicator and centers are unavailable, runout may also be detected by holding a gauge (Shindaiwa part number 20000-96210) between the assembled engine's flywheel and coil while slowly rotating the crankshaft (Figure 8.19).

☛ In this test, runout appears as a variation in the coil-flywheel gap when the crankshaft is rotated. Run-out revealed by this test indicates a distorted crankshaft that must be replaced.

## IMPORTANT!

The multiple-piece crankshafts used on Shindaiwa engines cannot be rebuilt.

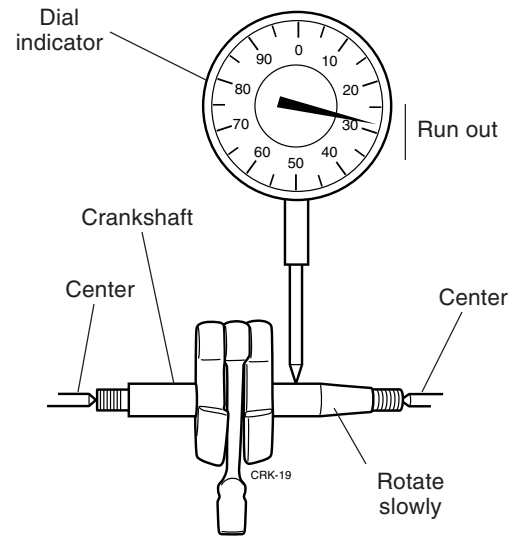


Figure 8.18 Measuring runout with a dial indicator

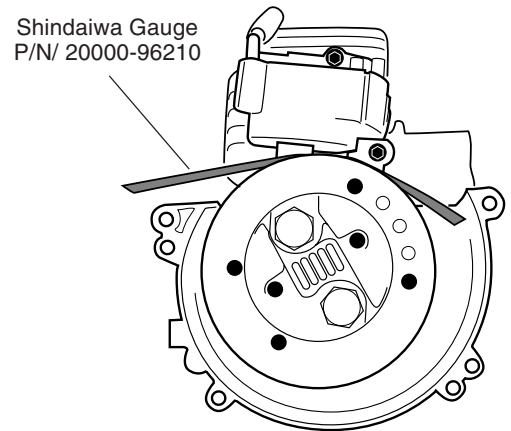


Figure 8.19 Measuring run out with a gauge



## Section 8 Engine Crankcase

### Crankcase/ Crankshaft Reassembly



#### WARNING!

Do not allow acetone or paint remover to contact your skin! Always wear gloves when working with solvents! Always follow solvent manufacturer's directions and cautions for proper use, cleanup, and disposal!

#### STEP 1. Clean fasteners and mating surfaces

Use acetone or a commercial gasket compound solvent to remove any oil or sealant remaining on crankcase-assembly fasteners and mating surfaces.

#### STEP 2. Apply Liquid Gasket™

Coat both crankcase half mating surfaces with a thin, even coating of 3-bond Liquid Gasket™, Shindaiwa stock number 11-04, or use an equivalent Shindaiwa-approved high-temperature liquid gasket material.

➤ *Do not allow liquid gasket to run into bolt holes or inside the engine crankcase.*

#### NOTE

Liquid Gasket will not stick to oily surfaces!

#### STEP 3. Install crankshaft in crankcase "M"

- Install the crankshaft's tapered end into crankcase half "M." Avoid damaging crankcase seals with the sharp edges of the crankshaft keyslot (Figure 8.20).
- Gently tap the crankshaft with a plastic or other soft-faced hammer until it "seats" in the crankcase bearing race.



#### CAUTION!

Avoid cutting the crankcase seals on the sharp edges of the crankshaft's keyslot or threaded ends. A "cocked" or otherwise off-center crankcase-half installation may also cause a sealing lip to "roll", causing possible damage to or loss of its retaining spring.

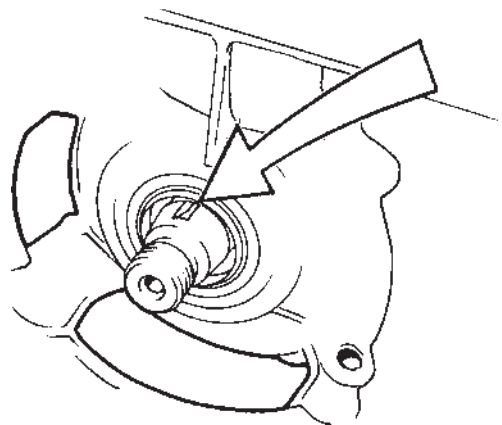


Figure 8.20 Avoid contacting seals with sharp edges of the keyslot.

### STEP 4. Install Crankcase "S"

- Carefully slide crankcase half "S" over the crankshaft and align its locating pins with the corresponding holes in crankcase "M."
- Gently tap crankcase half "S" into place with a soft-faced hammer (Figure 8.21).

### STEP 5. Install crankcase fasteners

Coat the crankcase screws with 3-Bond Liquid Screw Lock™ (Shindaiwa stock number 14-01) and torque to the specifications shown in the torque chart in the Appendix.

### Final Inspection

After the crankcase has been torqued to specifications, check for proper crankshaft centering by slowly rotating the crankshaft by hand.

- Any roughness or excessive drag may require centering the crankshaft within the crankcase by sharply tapping each crankshaft end with a soft-faced hammer (Figure 8.22).
- If roughness or drag persist, the halves must be disassembled and reinspected.

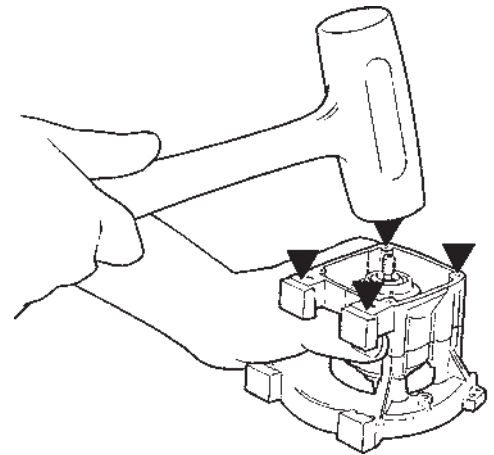


Figure 8.21 Installing crankshaft half "S"

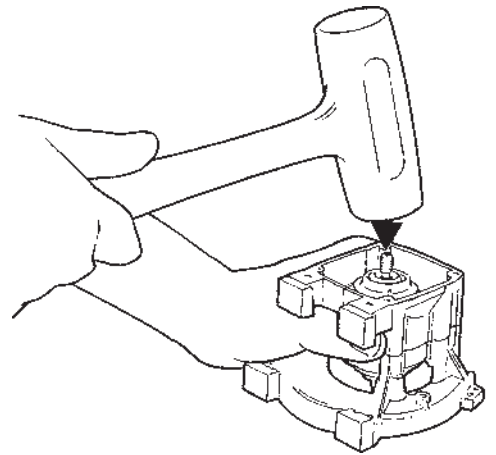


Figure 8.22 Crankshaft drag can usually be eliminated by sharply tapping the crankshaft ends with a soft-faced hammer.



Description

Current Shindaiwa trimmer and brushcutter models feature a unitized sheet-metal muffler bolted to the engine cylinder through an oversized gasket.

The one-piece muffler design eliminates annoying vibrations associated with component-style mufflers, and the oversized gasket also functions as a combination heat shield and cooling baffle.

Higher capacity mufflers feature a third mounting bolt for additional support.

All mufflers feature USFS-type spark arrestor screens, and screens can be easily removed for cleaning or replacement as required (Figure 9.1).

Service

Trimmer/brushcutter spark arrestor screens are susceptible to clogging over time, and should be inspected on at least annually.

➤ *More frequent inspection is required if an engine is operated with rich oil/fuel ratios, excessively rich carburetor adjustments, or is operated at low RPM for long periods of time.*

IMPORTANT!

Hard starting, gradual power loss, and poor high-RPM operation may indicate a clogged arrestor screen.

Spark Arrestor Removal

Muffler inspection and decarbonization can be performed with the muffler installed on the powerhead.

**STEP 1.** Remove the spark arrestor cover screws, then remove the cover and lift out the spark arrestor screen.

**STEP 2.** Burn carbon deposits from the screen with a propane or acetylene torch, or remove deposits by soaking the screen in an oven cleaner followed by a thorough cleaning in a solvent bath.



**WARNING!**

Oven cleaner is highly corrosive, and should never be used without proper eye, respiratory, and skin protection! Read and follow the manufacturer's use and safety precautions when working with oven cleaner!

Never allow oven cleaner to contact aluminum parts! Oven cleaner can quickly corrode and ruin aluminum!

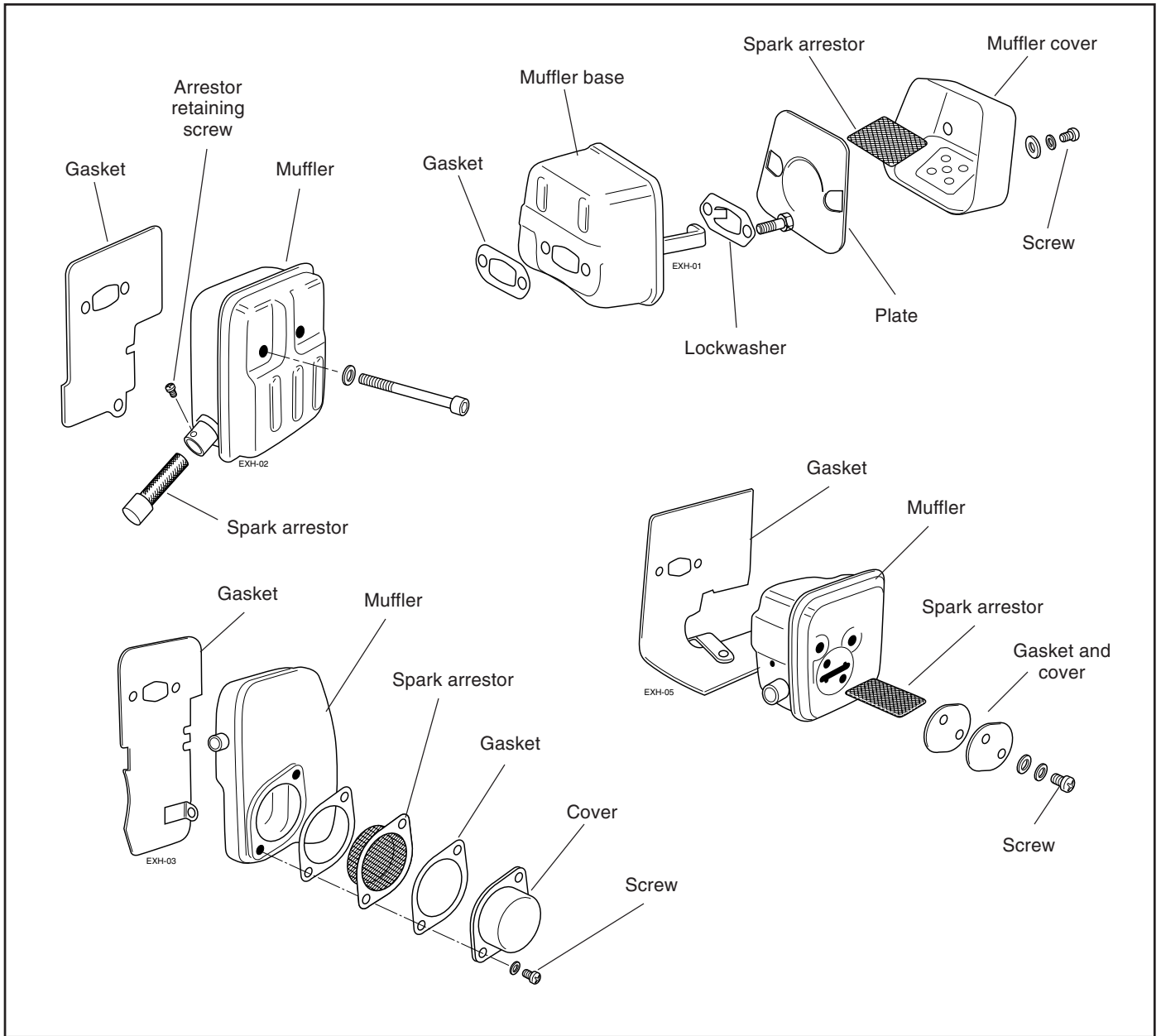


Figure 9.1 Shindaiwa muffler systems (typical)

## Muffler Removal

To inspect for carbon buildup at cylinder exhaust ports, remove the muffler from the powerhead by unscrewing two mounting bolts and a single support bolt (where used) located at the base of the muffler (Figure 9.2).



### CAUTION!

Never decarbonize cylinder ports while the cylinder is assembled to the engine! Dislodged carbon deposits may enter the engine, causing severe mechanical damage! See Section 7 for cylinder decarbonization procedure.

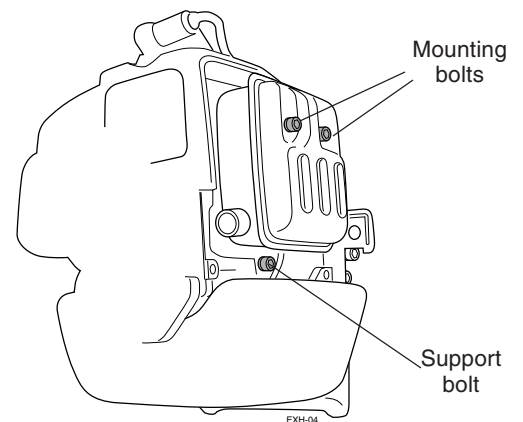


Figure 9.2 Muffler mounting systems.

## Reassembly

### Muffler Installation

**STEP 1.** Use a scraper to carefully clean the mating surfaces on both the muffler and cylinder flange.



#### CAUTION!

Do not allow carbon or other debris to enter the engine!

**STEP 2.** Install the two muffler bolts through the muffler and place a new Shindaiwa muffler gasket over the bolts.



#### CAUTION!

#### FIRE HAZARD!

Never operate a trimmer or brushcutter with a missing or leaking muffler gasket!



#### CAUTION!

The muffler gasket is an integral part of the engine cooling system. Installation or use of a damaged, modified, or otherwise non-standard muffler gasket can lead to engine failure through overheating!

**STEP 3.** Coat the muffler bolt threads with Three-Bond #13-60 Liquid Screw Lock.

**STEP 4.** Hand-tighten the muffler to the cylinder.

■ For mufflers with two attachment bolts, final-torque both bolts to the specifications listed in the Appendix.

■ For mufflers using a third support bolt, coat the support bolt's threads with #13-60 Liquid Screw Lock, then install and securely tighten the support bolt before torquing the two muffler bolts.



#### CAUTION!

A loose or missing muffler support bolt can allow the muffler to loosen during operation, elongating the bolt threads and possibly fracturing the cylinder flanges! Always make sure all muffler bolts are correctly installed!

### Spark Arrestor Installation (Typical)

Assemble the spark arrestor in the reverse order of disassembly.

Replace all gaskets with new Shindaiwa gaskets of the appropriate part number, and then securely tighten the arrestor cap retaining screw(s).



#### **CAUTION!**

Operating a trimmer or brushcutter with a missing or damaged spark arrestor is a fire hazard, and may also be illegal in your area! Consult USFS and state/local authorities for applicable safety notices and regulations!

**Straight Shaft Trimmers**

All Shindaiwa straight-shaft trimmers and brushcutters feature one-piece high-carbon steel mainshafts.

Shafts are splined at both ends to minimize wear and vibration, and are usually supported by either four or five pre-lubricated bushings housed in an extruded aluminum outer tube.

Shaft bushings are isolated from the outer tube by rubber anti-vibration (A-V) mounts.

On most models, torsion control is provided by either a hollowed or relieved mainshaft.

Outer tube dimensions vary between models (refer to Specifications in the Appendix), but all tubes are manufactured from aircraft aluminum and are mandrel-drawn. This manufacturing process produces a seamless outer tube with consistent tolerances, superior bend resistance, and a nearly flawless finish.

### Disassembly

#### Mainshaft Removal

**STEP 1.** Remove either the powerhead or gearcase from the shaft tube.

**STEP 2.** Slide the mainshaft from the outer tube assembly.

#### IMPORTANT!

Note mainshaft orientation during disassembly! A hollow mainshaft may be installed end-for-end, but a relieved (narrowed) mainshaft **must** be installed with its narrowed torsional relief toward the engine (Figure 10.1)!



#### CAUTION!

Do not remove plugs from hollow mainshaft ends! Plugs are installed to prevent gearcase grease from travelling up the mainshaft tube!

#### Mainshaft Inspection

Inspect the mainshaft for signs of unusual wear at each of the bushing locations.

- A normal mainshaft will display a slight stain or "print" where it turns in each bushing.
- Pitting, scoring, or galling on the mainshaft (Figure 10.2) indicates a bushing failure. In that event, **the mainshaft and all damaged bushings must be replaced!**

Where used, a relieved mainshaft must always be installed with its relieved end closest to the powerhead.

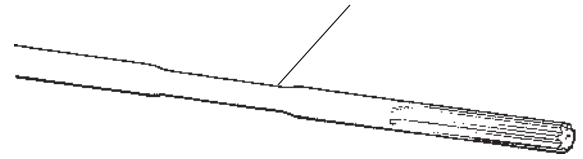


Figure 10.1 Torsional relief section of the shaft.

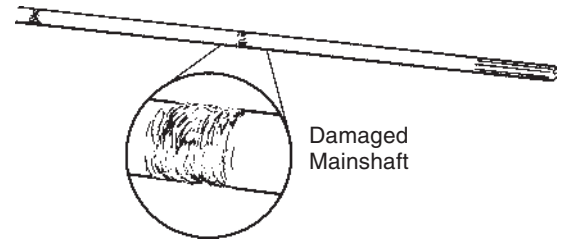


Figure 10.2 Inspect the mainshaft.

# Section 10 Mainshafts and Outer Tubes

## Mainshaft Inspection

**STEP 1.** Inspect both mainshaft splines for damage or wear (Figure 10.3). When in doubt, compare spline depth and condition with that of a new shaft from the same model.

**STEP 2.** Verify mainshaft straightness by rolling the shaft on a flat surface or by rotating it in a straight length of angle-iron. Replace any shaft that is noticeably worn or distorted.



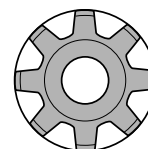
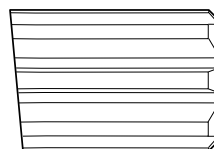
### CAUTION!

Although an outer tube assembly will often return to shape after being bent or bowed through careless handling, such abuse can permanently bend the mainshaft inside.

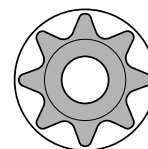


### CAUTION!

A bent shaft and/or damaged splines can cause rapid wear of the (softer) clutch drum splines. If you discover a bent shaft and/or damaged splines, inspect the clutch drum splines by test-fitting a new shaft as shown in Figure 10.4.



Normal



Worn

SFT-06

Figure 10.3 Spline damage usually results from a bent or bowed mainshaft.

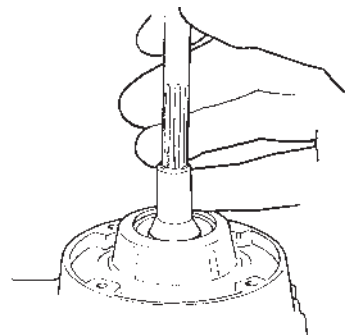


Figure 10.4 Inspect the clutch drum splines by test-fitting a new shaft.

## Bushing Removal

### IMPORTANT!

Proper bushing removal and installation requires Shindaiwa Bushing Driver p/n 22000-96101.



### CAUTION!

Proper use of the Shindaiwa Bushing Driver minimizes the risk of improperly positioned bushings, or damage to the outer tube assembly.

**Use Shindaiwa-approved service tools only! Makeshift bushing drivers such as wooden dowel rods or plumbing pipes can permanently damage the outer tube assembly!**

**STEP 1.** Hold the outer tube vertically with its lower end pressed firmly against a scrap of wood placed on the floor.

**STEP 2.** Slide the bushing driver into the upper end of the outer tube, and use the driver in a slide-hammer fashion to force all five bushings against the wood scrap at the bottom end of the tube.

**STEP 3.** Lift the tube slightly and continue using the bushing driver. The entire stack of bushings should slide from the tube (Figure 10.5).

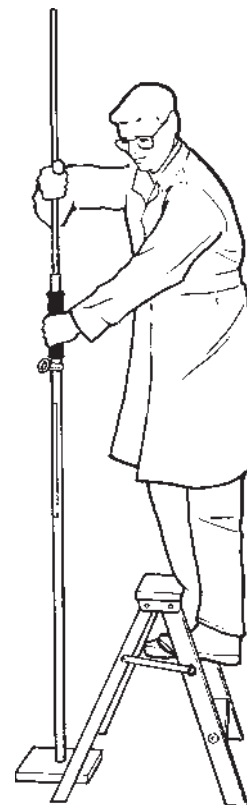


Figure 10.5 Use bushing driver p/n 22000-96101 in a slide-hammer fashion to force bushings from the shaft tube.

## Bushing Removal (continued)

### NOTE:

Removal of stubborn bushings may require striking the driver with a mallet or dead-blow hammer. Bushings may drive more easily if first treated with a lightweight oil such as WD-40™.

- To avoid spreading grease during bushing removal, wrap the end of the shaft tube in rags or paper.

### Bushing and Tube Inspection

**STEP 1. Inspect the outer tube.** Discard any tube that is cracked, distorted, or bent.

**STEP 2. Carefully inspect the bushings and rubber a/v mountings.** Discard if worn or damaged.

## Assembly

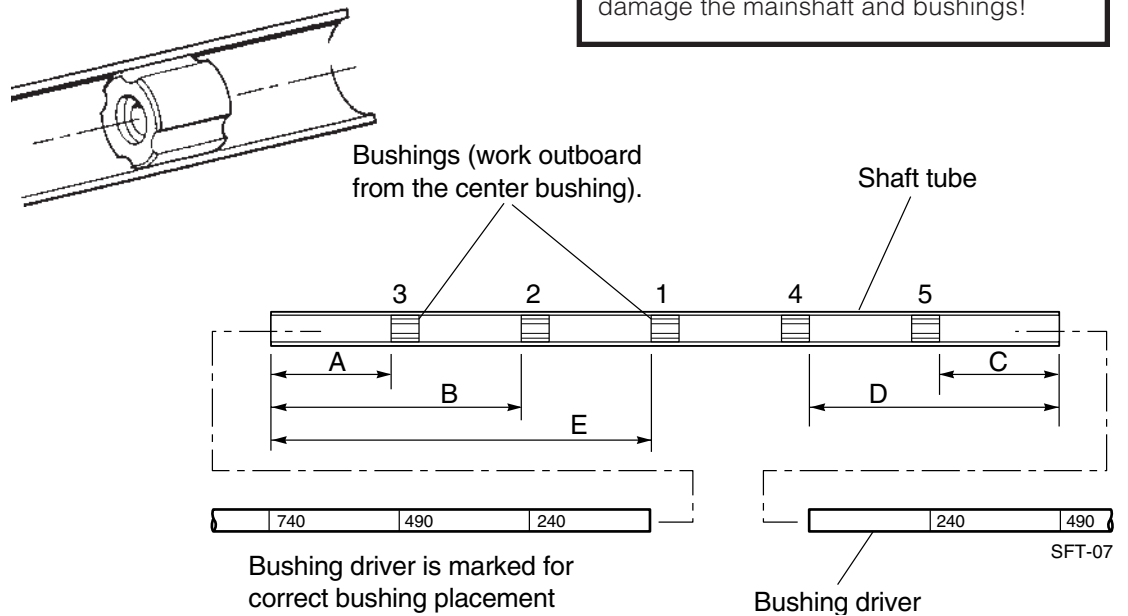
### Bushing Installation

Installation technique is similar to removal, except that bushings are installed individually from the center of the tube out (Figure 10.6). A lightweight oil such as WD-40 can greatly ease the installation process.



### CAUTION!

Bushing depth is critical to overall performance! Improper bushing depth may induce shaft vibration, and can damage the mainshaft and bushings!



Model	Bushing Locations (mm)				
	A	B	C	D	E
T/LT-18, T/C-230	240	490	240	490	740
T/C-20, T/C-25, T/C-27, T/C-250	240	490	240	490	740
C-35, B-40, B-45, RC-45	223	456	223	456	690
BP-35	Four bushings used; measure equal 280 mm increments from the gearcase				

Figure 10.6 The use of a bushing driver ensures proper bushing alignment and spacing.



## Assembly (continued)

### Bushing Alignment

Bushings may occasionally become misaligned or “cocked” during installation (Figure 10.7).

- Check alignment by holding the outer tube vertically while inserting the mainshaft. Once the shaft has passed the first two bushings, it should pass freely through the remaining three.
- If the shaft catches or “hangs” at any bushing, the bushing is misaligned and must be either realigned or replaced.
- Before removing and replacing the bushing, attempt realignment by using the following procedure:

**STEP 1.** Find the misaligned bushing’s exact location in the shaft tube using the mainshaft as a depth guage.

**STEP 2.** Mark the misaligned bushing’s location on the outside of the shaft tube with a soft lead pencil.

**STEP 3.** Install the mainshaft through all five bushings.

**STEP 4.** Realign the bushing by sharply tapping the tube around the misaligned bearing with a soft-faced hammer.

**STEP 5.** Recheck alignment by removing and reinstalling the mainshaft.

### Mainshaft Installation

Apply a light coating of Shindaiwa Premium Gearcase Lube to the mainshaft and splines, then install the mainshaft in the outer shaft tube.

Reinstall powerhead and/or gearcase in the reverse order of removal.

If otherwise undamaged, a cocked bushing can usually be realigned by sharply tapping the shaft tube with a soft-faced hammer.

**THE MAINSHAFT MUST BE INSTALLED DURING THIS PROCEDURE!**

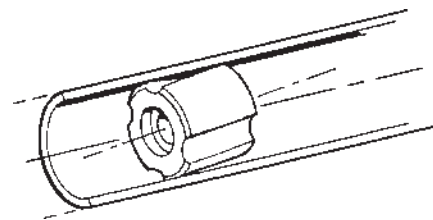


Figure 10.7 Re-aligning a cocked bushing.



### CAUTION!

Torsion-relieved mainshafts **must** be installed with the relieved (narrowed) section toward the powerhead end of the shaft tube! Reversed installation will cause the mainshaft to vibrate, leading to accelerated spline wear. If subjected to high shock loads, an improperly oriented shaft may fail during use!

### Troubleshooting

#### Vibration Complaints

Trimmer/brushcutter vibration can be difficult to trace by touch alone. Vibrations generated by a faulty powerhead or unbalanced accessory can travel along the entire length of the machine.

☛ *The dynamic range (rpms) where a vibration is reported will often reveal its actual source:*

- Vibration at low rpm only is likely from normal clutch engagement, and can often be “cured” by educating the user (Refer also to Section 6, Clutch Orientation).
- Vibration within a narrow rpm band during cutting is often caused by an out-of-balance attachment.
- Vibration above clutch engagement speeds and throughout the entire rpm range often indicates a bent shaft and/or damaged shaft and bushings.

When tracking vibrations by elimination, a good rule of thumb is to work inward from each end of the machine (see Vibration Troubleshooting at the end of this Section).

#### Flexible Cable Trimmers (Figure 10.8)

- Shindaiwa models F-18, F-20, F-21, and F-230 all use a flexible mainshaft cable turning in a flexible plastic liner.
- Model BP-35 features a unique combination of a flexible shaft spliced to a rigid mainshaft assembly.
- All flex-shaft cables have a piano wire core surrounded by a multi-layered piano wire outer wrapping.
- The cable diameter on all curved-shaft trimmers is 6 mm. The flexible drive cable used on model BP-35 is 8 mm in diameter.
- An aluminum alloy outer tube is standard on all models except F-20, which uses a steel outer tube.

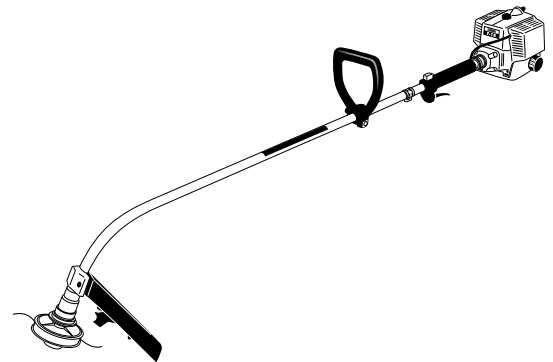


Figure 10.8 A Shindaiwa flex-shaft trimmer (F-18 shown)

## Typical Cable Maintenance (Except BP-35)

- STEP 1.** Remove the shaft case housing index bolt and loosen the clamp bolt (Figure 10.9).
- STEP 2.** Remove the shaft case housing and withdraw the flexible shaft.
- STEP 3.** Clean the flexible shaft in solvent, and recoat its entire length with Shindaiwa Premium Gearcase Lube.
- STEP 4.** Reinstall the flexible shaft in the tube housing. To insure full engagement with the powerhead, rotate the flex-shaft slowly during installation.
- STEP 5.** Fill the shaft case housing with fresh grease and reinstall it on the shaft tube. If necessary, rotate the shaft case output shaft to properly align its drive socket with the squared end on the flexible cable.
- STEP 6.** Install and tighten the shaft case index screw, and then securely tighten the clamp screw.



### CAUTION!

The flexible cable must fully engage both the powerhead and the output shaft drive sockets! Incomplete engagement can shorten cable life drastically!

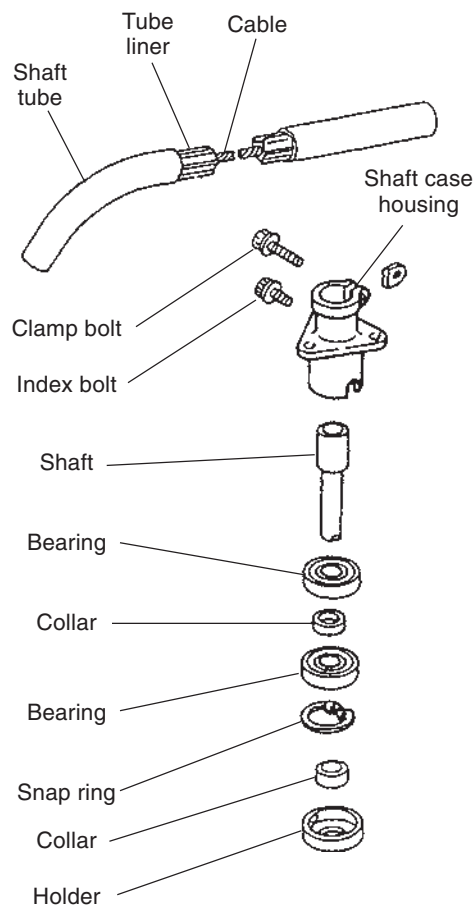


Figure 10.9 Cable drive, exploded view

## BP-35 Maintenance

### Straight Shaft and Gearcase

- Service and maintenance procedures for the BP-35 gearcase are identical to those for all Shindaiwa straight-shaft trimmers and brushcutters and are outlined in the Gearcase section.
- Service and maintenance procedures for the BP-35 outer tube and mainshaft assembly are similar to those outlined earlier in this section, except that the BP-35 outer tube requires only four bushings.
- Use Shindaiwa Bushing Driver p/n 22000-96101 when servicing BP-35 outer tube bushings. Correct spacing for BP-35 bushings is 11.02" (280mm).

## BP-35 Maintenance (continued)

### Flexible Shaft

- STEP 1.** Unplug the two stop switch wires, disconnect the throttle cable from the handle, and remove the index screw from the rear handle grip (Figure 10.10).
- STEP 2.** Pull the flexible tube assembly from the rear handle and outer tube assembly.
- STEP 3.** Slide the flexible cable from the flexible tube assembly (Figure 10.11), and wash the cable thoroughly in a solvent bath.
- STEP 4.** Inspect the cable carefully, and discard if worn or damaged.
- STEP 5.** Use a rag to remove any excess grease from inside the rear handle grip assembly.



#### CAUTION!

Excess grease in the rear handle assembly may cause the shaft tube to overheat!

- STEP 6.** Coat the entire length of the flexible cable with Shindaiwa Premium Gearcase Lube. Reinstall the cable in the flexible tube assembly.
- STEP 7.** During installation, rotate the flex-cable by hand to insure full engagement with the powerhead.

The remainder of the assembly is the reverse of disassembly.



#### CAUTION!

Inadequate lubrication can cause rapid wear of both the flex-cable and liner, resulting in increased vibration and greatly decreased service life!

Flexible cables (all units) must be cleaned and relubricated at least every 50 hours of operation, or whenever a unit is returned to service after extended storage.

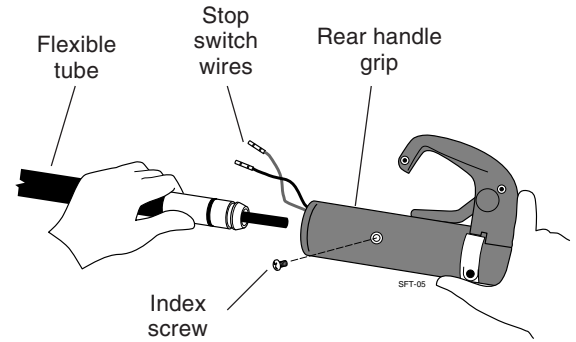


Figure 10.10 Separate the flexible tube from the rear handle grip.

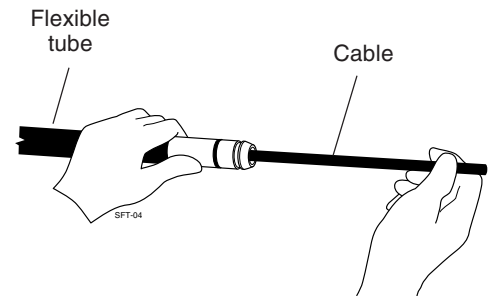


Figure 10.11 Remove the flexible cable.

## Troubleshooting Vibration Problems

### NOTE:

A logical and systematic approach is essential when troubleshooting vibration complaints.

Begin by defining the type of vibration and especially the rpm range where vibration occurs. A low-rpm vibration or chatter that disappears on acceleration, for example, may be nothing more than normal clutch engagement.

On the other hand, legitimate vibration complaints may not be completely or permanently solved by simply replacing parts at random.

### All Units

- Check the outer tube for damage. Inspect the mainshaft for burning, discoloration, straightness (see Shindaiwa Service Bulletin SB-31).
- Verify bushing alignment by inserting a known-good mainshaft while holding the tube vertically. The mainshaft should pass through the bottom three bushings without stopping.
- Check the powerhead rotor for debris or damaged/missing fins.
- Damaged or “glazed” clutch shoes may chatter and vibrate. Check for damaged springs, worn boss area, correct shoe orientation.

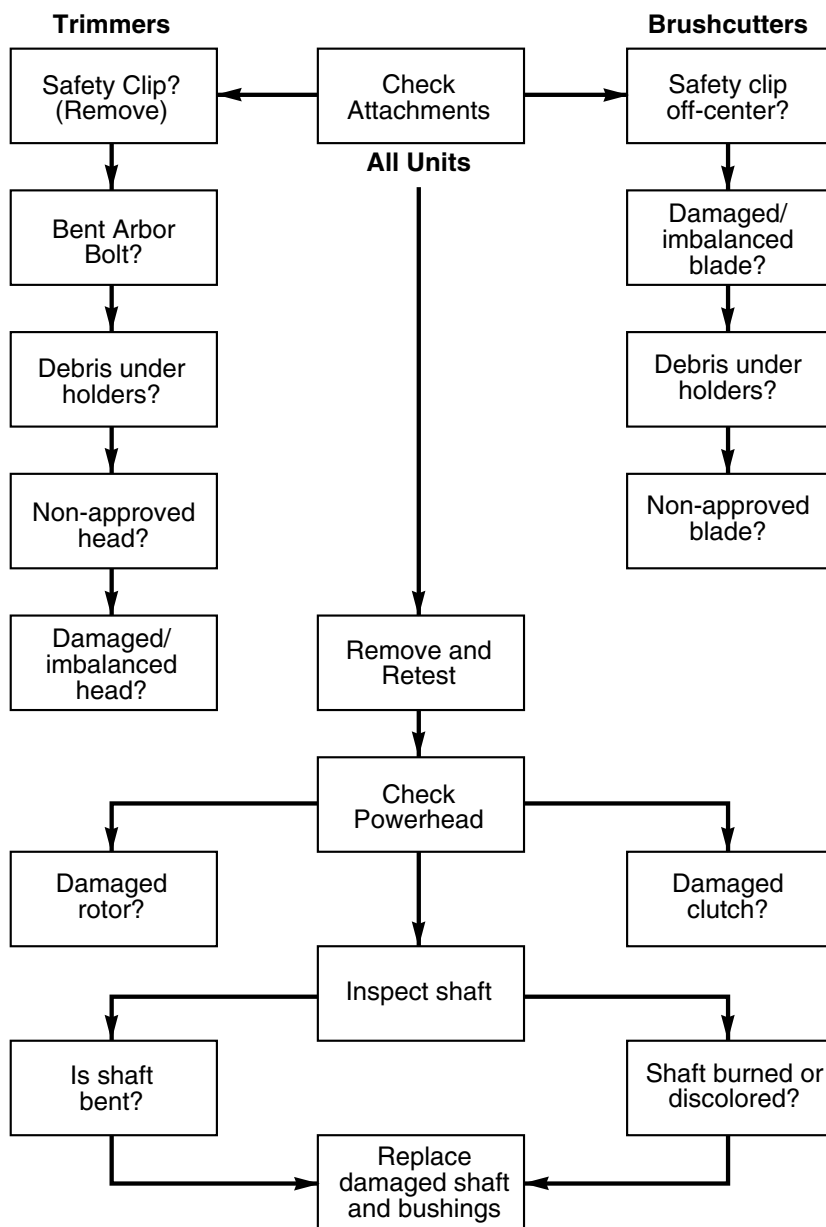
### Trimmers

- When using a T/C-25 with a trimmer head, **always** remove the safety clip from between the blade holders!
- Arbor bolts can be bent from improperly advancing the line during operation.
- Check for accumulated debris packed around attachment base or holders
- Check for proper line size and length. Verify correct parts and accessories with the Illustrated Parts List (IPL).
- Check trimmer head for warpage, out-of-round, or other damage or imbalance.

### Brushcutters

- A “cocked” or otherwise off-center safety clip can prevent holders from laying flat against the blade, resulting in out-of-balance operation.
- Check for missing or damaged teeth and/or for warped, out-of-round, or distorted blades. Verify correct blade and holder using the IPL.
- Check for accumulated debris packed around the attachment head or holders.

## Diagnosing Vibration Complaints



## General Description (Figure 11.1)

All Shindaiwa gearcases feature hardened pinion gears supported by four ball bearings running in a cast aluminum housing with machined bearing bores.

The gearcase assembly is also machine-bored to accept the trimmer shaft tube and is secured to the shaft tube by a clamp screw and (most units) a locating bolt.

The gearcase drive gear is internally splined to accept the trimmer mainshaft. The output shaft features both external splines and internal threads to accommodate a wide variety of cutting attachments.

Gear lubricant is lithium-based grease, and lubricant replacement is accomplished by removing a shaft collar and injecting fresh grease through a threaded hole in the side of the gearcase.

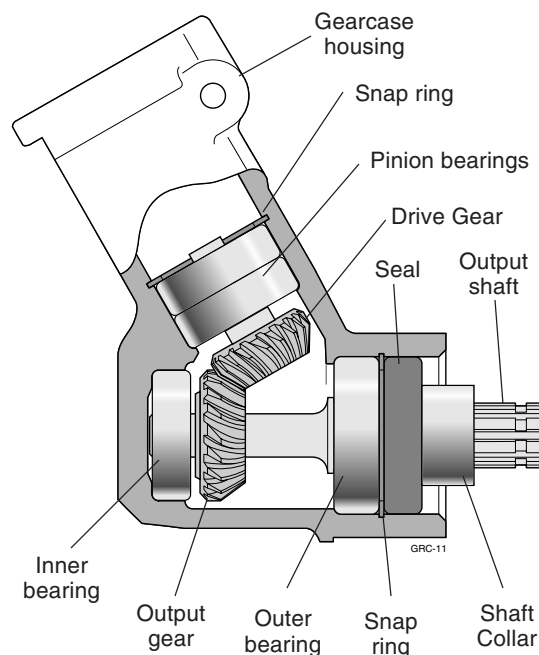


Figure 11.1 This Shindaiwa gearcase assembly uses four ball bearings in a cast aluminum housing with machined bearing bores.

## Disassembly except Models T/C-250

### IMPORTANT!

Special tools required for gearcase service are listed in the Appendix.

**STEP 1.** Remove the cutting attachment and blade holders. Use slip-joint pliers to withdraw the shaft collar (Figure 11.2).

**STEP 2.** Loosen the clamp screw, remove the locating screw and gearcase filler plug, and slide the gearcase assembly from the shaft tube.



### CAUTION!

The mainshaft is splined at both ends and can easily be damaged if allowed to fall from the shaft tube!

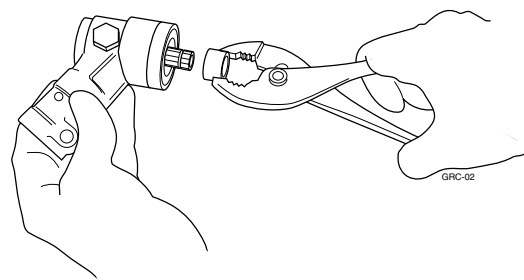


Figure 11.2 Removing the shaft collar.

**STEP 3.** Use snap ring pliers such as Snap-On® PR-23A or equivalent to remove the snap ring from the output (cutting attachment) end of the gearcase (Figure 11.3).



### WARNING!

Always wear safety glasses when working with snap rings!

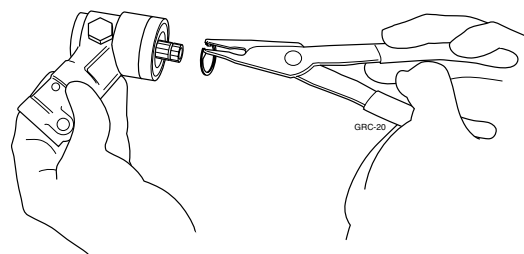


Figure 11.3 Removing the snap ring from the output side of the gearcase.

## NOTE:

Models T-18, T-20, T/C-230, T/C-250 and later-series T/C-27 require removing the gearcase output seal before removing the output-side snap ring.

- To remove the output seal from these models, use a pick or small screwdriver to pry the seal from the gearcase (Figure 11.4).

➤ On models with the output seal installed beneath the snap ring, the seal is normally removed with the output shaft and bearing assembly.



## CAUTION!

When removing seals, avoid damaging gearcase bearings beneath!

## Output Shaft and Bearing Removal

**STEP 1.** Thread the appropriate puller bolt completely into the puller body (Figure 11.5).

**STEP 2.** Thread the shaft puller bolt into the gearcase output shaft (turn counter-clockwise) until the puller body bottoms against the gearcase.

**STEP 3.** Continue turning the puller bolt until the output shaft and bearing assembly are completely free from the gearcase housing.

## NOTE:

If the shaft is difficult to remove, use a heat gun to pre-heat the gearcase to approximately 212°F (100°C).

## Pinion and Bearing Removal

**STEP 1.** Use snap ring pliers such as Snap-On® p/n PR-23A or equivalent to remove the internal snap ring from the input (driveshaft) end of the gearcase (Figure 11.6).

**STEP 2.** Thread the appropriate long puller bolt into the base of the pinion puller tool.

**STEP 3.** Assemble the puller to the gearcase and pinion (Figure 11.7), then rotate the puller bolt to remove the pinion and bearing assembly.

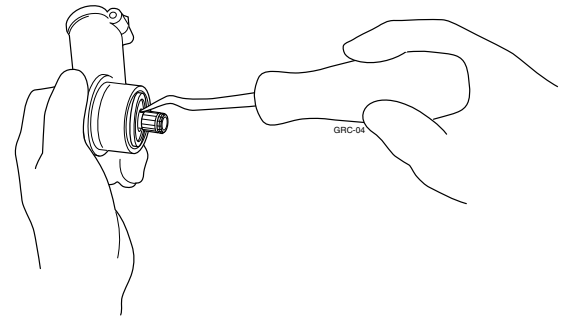


Figure 11.4 Use a pick or small screwdriver to pry out the output seal from the gearcase.

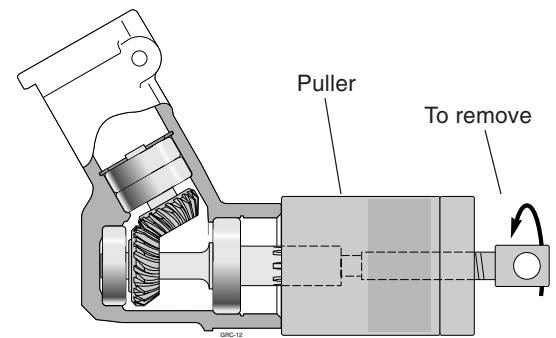


Figure 11.5 Removing the output shaft.

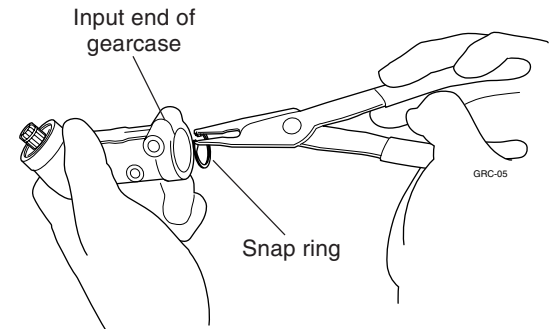


Figure 11.6 Remove the snap ring from the input end of the gearcase.

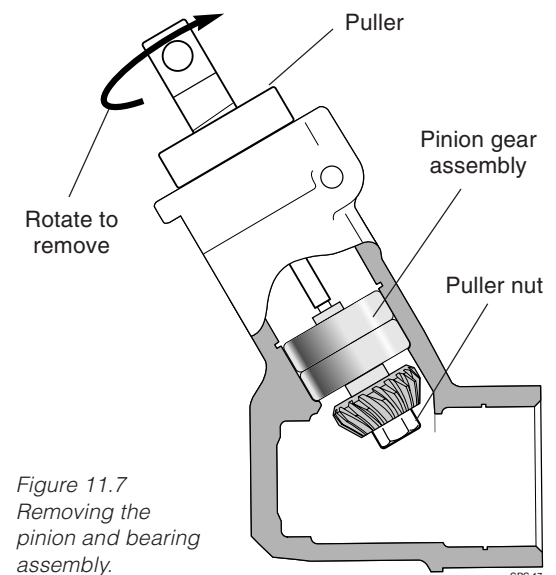


Figure 11.7 Removing the pinion and bearing assembly.



## Disassembly except Models T/C-250 (continued)

### Inner Bearing Removal

■ Use a heat gun to pre-heat the gearcase to approximately 212°F (100°C), and then remove the inner bearing by tapping the gearcase output end sharply against a flat wooden surface (Figure 11.8).

### NOTE:

Failure of the sealed inner gearcase bearing is unusual. Do not remove this bearing unless it is damaged.

### Inspection

- Carefully inspect all gears, shafts, splines, and threaded areas for mechanical damage or overheating.
- Spin all bearings and discard those that feel rough, loose, or are difficult to spin.
- Inspect the gearcase for stripped threads, damaged bearing bore or snap ring groove, distortion, or other physical damage.
- Discard any damaged or excessively worn component.

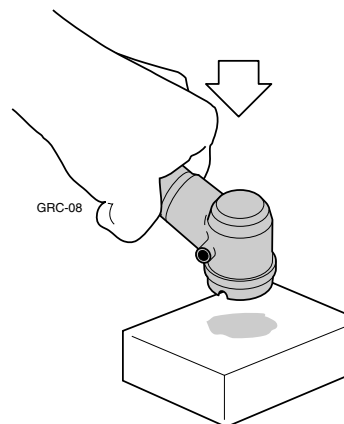


Figure 11.8 Removing the inner bearing.

## Reassembly except Models T/C-250

### IMPORTANT!

Three special drivers are required for gearcase reassembly! Gearcase tools are listed in the Appendix. Do not attempt reassembly without the proper tools (refer to the Special Service Tools section of the Appendix).



### CAUTION!

Avoid bearing rebound! Improperly installed or poorly seated bearings can cause a gearcase to "bind," and may cause early gearcase failure! Use a soft-faced "dead blow" hammer when seating bearings! Always drive bearings against a wooden block or benchtop!

### Inner Bearing Installation

Using the appropriate bearing driver, install and seat the sealed inner bearing into the gearcase (Figure 11.9).

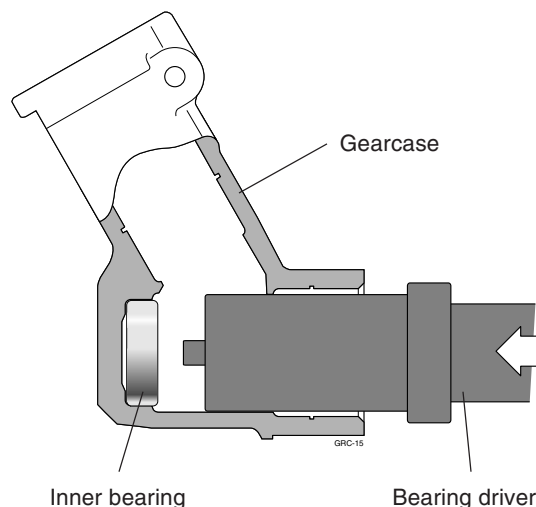


Figure 11.9 Installing the pinion and bearing assembly.

## Pinion (drive) Gear and Bearing Installation

**STEP 1.** Hand-fit the pinion and bearing assembly into the gearcase input end, and use the appropriate driver to seat the assembly past the internal snap ring groove (Figure 11.10).

### NOTE:

If installation is difficult, use a heat gun to expand the gearcase slightly during installation.

**STEP 2.** Install the pinion bearing snap ring.

### IMPORTANT!

Snap rings are manufactured using a stamping process that produces a rounded or “rolled” edge on one side of the ring and a “sharp” (90°) edge on the other. The “sharp” edge of a snap ring must always face away from the bearing it retains (Figure 11.11)!

## Output (driven) Gear and Shaft Installation

**STEP 1.** Using hand pressure only, locate the output gear in the gearcase (Figure 11.12).

**STEP 2.** Insert the output shaft into the output gear.

**STEP 3.** Align the output shaft to the inner bearing by slowly rotating the shaft by hand.

**STEP 4.** Drive the shaft in place using the appropriate driver and a soft-faced hammer. Verify correct installation and alignment by rotating the shaft by hand.

## Output Seal and Snap Ring Installation

### NOTE:

Order of assembly is reversed for T-18, T-20, and later models of T/C-27 (Figure 11.13, on the following page).

**STEP 1.** Pre-lubricate a new output shaft seal with Shindaiwa lithium-based gearcase lube.

**STEP 2.** Use a soft-faced hammer to start the seal in the gearcase bore.

**STEP 3.** Using the appropriate seal driver and a soft-faced hammer, seat the output shaft seal in the gearcase

**STEP 4.** Place the output-side snap ring on a snap ring plier, with its “sharp” (90°) edge toward the plier handles. Install the output-side snap ring in the gearcase.

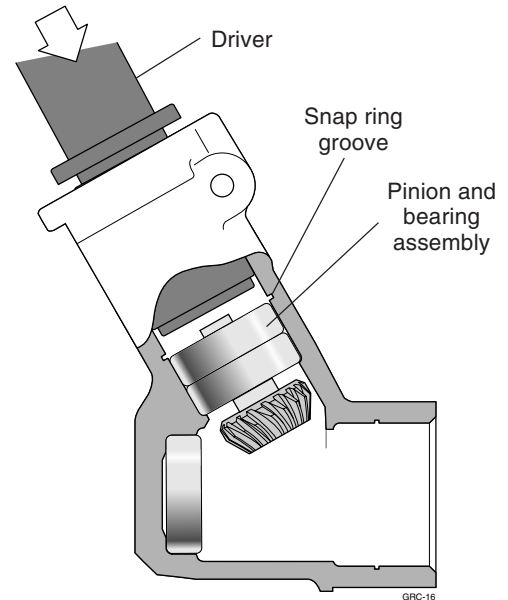


Figure 11.10 Installing the pinion and bearing assembly.

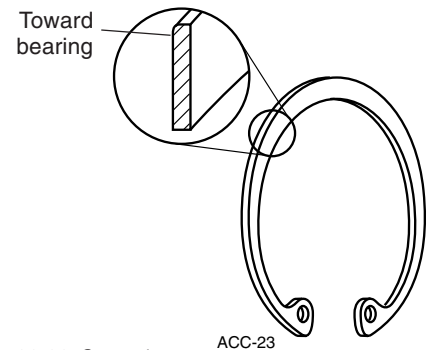


Figure 11.11 Snap ring.

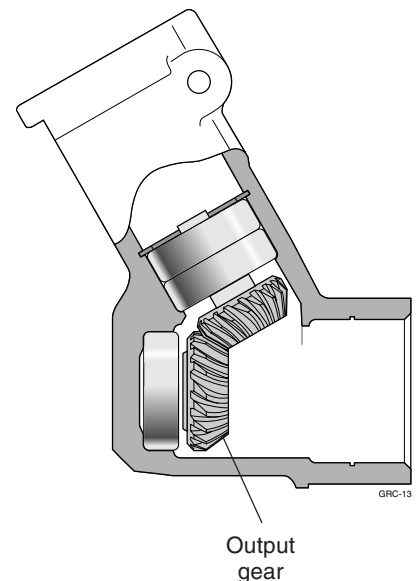


Figure 11.12 Hand-fit the output gear into the gearcase.

## Reassembly except Models T/C-250 (continued)

### Inspection

■ Slowly rotate the output shaft by hand, and check for excessive bearing “drag”.

☛ *Excessive drag usually can be eliminated by tapping the input end of the gearcase sharply with a soft-faced hammer (Figure 11.14).*



### CAUTION!

Excessive drag will increase operating temperature and can lead to early gearcase failure! If excessive drag cannot be eliminated with the above method, the gearcase must be disassembled for reinspection!

### Lubrication

■ Fill the gearcase with Shindaiwa™ lithium-based gearcase lube (Figure 11.14), then replace the gearcase grease plug and grease collar in the reverse order of disassembly.

### IMPORTANT!

Do not overfill the gearcase! Fill the gearcase **only** until grease is visible at the output seal!



### CAUTION!

The grease collar **must** be removed whenever the gearcase is being refilled! Failure to remove the grease collar during refilling operations can force lubricant to travel up the shaft tube, and may cause the gearcase to overheat!

### Gearcase Installation

**STEP 1.** Lightly coat the mainshaft splines with Shindaiwa™ lithium-based gearcase lube, then gently push the gearcase assembly onto the shaft tube (Figure 11.15).

☛ *If you have difficulty engaging the spline, rotate the gearcase slowly by hand during installation.*

### IMPORTANT!

The gearcase clamp assembly has a D-shaped washer that prevents overtightening the clamp screw. The gearcase cannot be installed unless the washer is positioned as shown in Figure 11.16.

**STEP 2.** Install and tighten the gearcase locating screw, then securely tighten the gearcase clamp screw. Install holders and attachments in the reverse of disassembly.

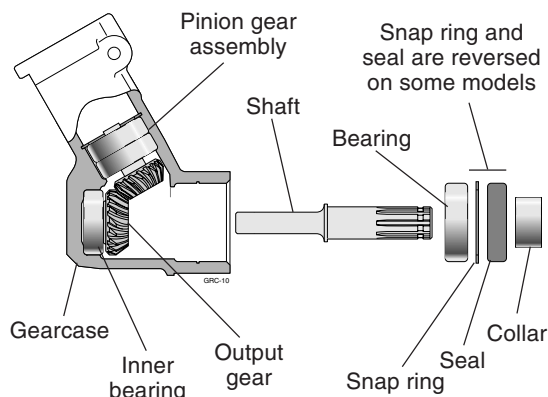


Figure 11.13 Gearcase final assembly.

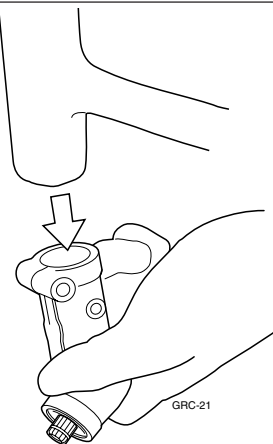
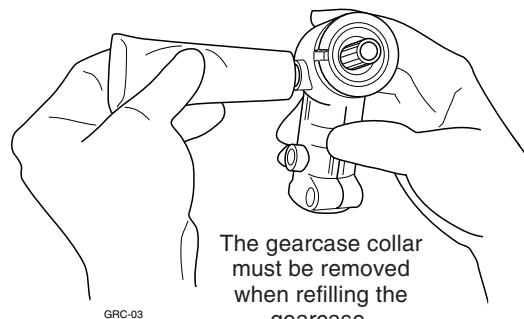


Figure 11.14 Removing excess drag.



The gearcase collar must be removed when refilling the gearcase.

Figure 11.15 Refilling the gearcase.

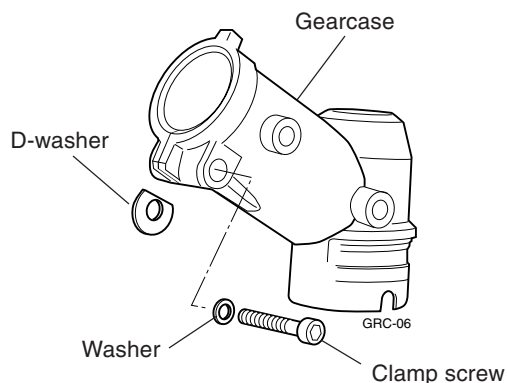


Figure 11.16 D-washer installation.

## Models T/C-250 Gearcase (Figure 11.17)

### General

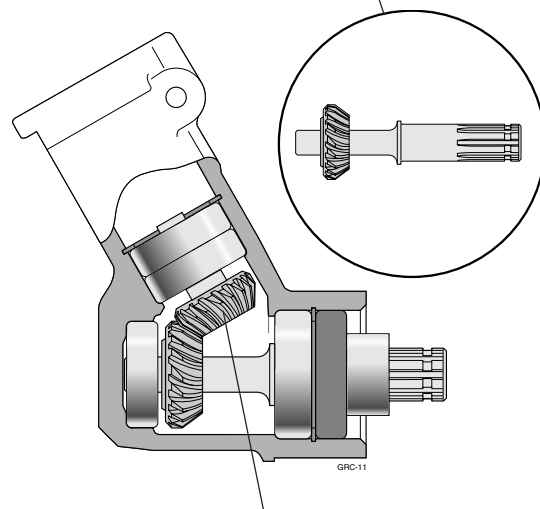
Overall appearance and theory of operation of the T/C-250 gearcase is similar to earlier models, except that the T/C-250 output (driven) shaft and gear are supplied as a single part number and cannot be disassembled for service.

Therefore, the pinion (drive) gear and bearings must be removed from the input end of the gearcase before the output shaft assembly can be removed from the housing.

### Tools Required for Disassembly

Use the gearshaft puller designed for Shindaiwa T/C-250 and T-20 units, but substitute the 8 mm puller bolt from the puller used for T/C-25 and T/C-27 units. Refer to the Appendix for puller part numbers.

The output shaft and gear cannot be disassembled for service



The pinion gear and bearings must be removed before pulling the output shaft.

Figure 11.17 Shindaiwa 250-series gearcase.

## Disassembly Models T/C-250

- Remove the cutting attachment and blade holders (same as for all models. Figure 11.18).
- Remove the clamp screw and D-shaped washer, locating screw, and gearcase filler plug. Slide the gearcase assembly off the shaft tube.
- Remove the internal snap ring from inside the input (driveshaft) end of the gearcase. Use snap ring pliers such as Snap-On® PR-23A or equivalent (Figure 11.18).



### WARNING!

Always wear safety glasses when working with snap rings!

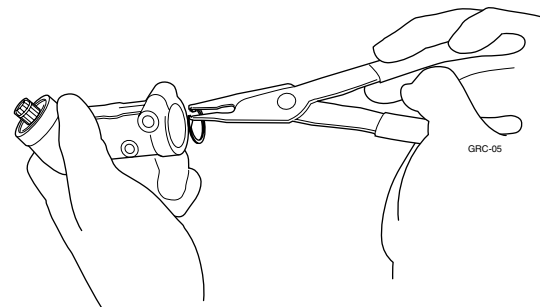


Figure 11.18 Remove the snap ring from the input end of the gearcase.

## Disassembly

Models T/C-250  
(continued)

### Pinion Gear and Bearing Removal

**STEP 1.** Use a screwdriver to gently spread the clamp at the input (drive) end of the gearcase.

**STEP 2.** Pre-heat the gearcase to approximately 212°F (100°C) with a heat gun. Then remove the drive pinion and bearing seat from the gearcase by tapping the input end of the gearcase sharply against a flat wooden surface (Figure 11.19).

### IMPORTANT!

Steel-faced or other hardened striking tools should never be used in gearcase disassembly!

### Oil Seal and Snap Ring

- Carefully pry the oil seal from the output side of the gearcase using a pick or straight-bladed screwdriver.
- Remove the snap ring from the output (cutting attachment) end of the gearcase using snap ring pliers.

### Output Shaft and Bearing Removal

**STEP 1.** Thread the puller bolt completely into the puller body.

**STEP 2.** Thread the shaft puller bolt into the gearcase output shaft (turn counter-clockwise) until the puller body bottoms against the gearcase (Figure 11.20).

**STEP 3.** Continue turning the shaft bolt until the output shaft and bearing assembly are completely free from the gearcase housing.

### NOTE:

If shaft removal is difficult, use a heat gun to pre-heat the gearcase to approximately 212°F (100°C).

### Inner Bearing Removal

- Pre-heat the gearcase with a heat gun to approximately 212°F (100°C). Remove the inner bearing by tapping the gearcase sharply against a flat wooden surface (Figure 11.21).

### Inspection

Inspection procedures are the same as for other models, except that the output shaft and driven gear must be serviced as a single assembly.

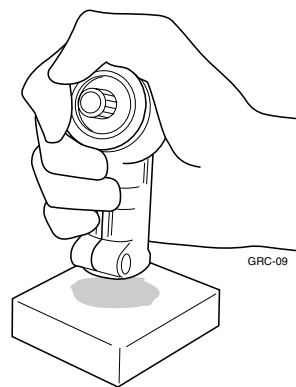


Figure 11.19 Removing the 250 pinion gear.

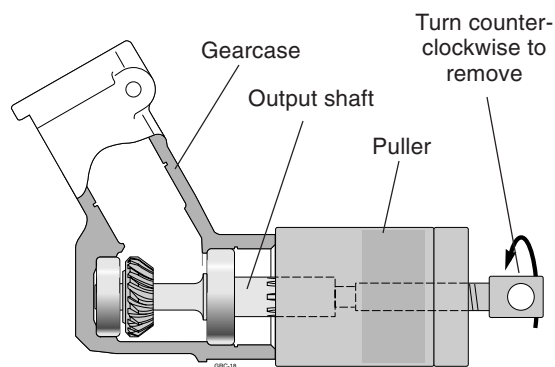


Figure 11.20 Removing the 250 output shaft.

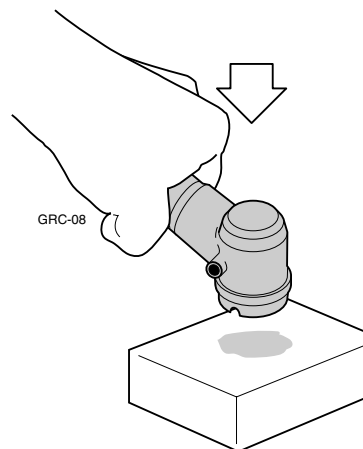


Figure 11.21 Removing the 250 inner bearing.

## Reassembly Models T/C-250

Assembly is basically the reverse of disassembly.

**STEP 1.** Replace the inner bearings (if they were removed).

**STEP 2.** Hand-fit the output shaft and gear assembly to the inner bearing, then seat it firmly with a soft-faced hammer (Figure 11.22).

**STEP 3.** Seat the output shaft bearing using the appropriate bearing driver until it bottoms past the internal snap ring groove (Figure 11.23).

**STEP 4.** Install the output shaft snap ring with its “sharp” edge facing out.

**STEP 5.** Gently spread the clamp at the input (drive) end of the gearcase with a screwdriver blade (same as in T/C-250 disassembly), then hand fit the pinion gear and bearing set into the gearcase.

**STEP 6.** Using the appropriate bearing driver and a soft-faced hammer, seat the pinion gear and bearing set past the internal snap ring groove.

☛ *If installation is difficult, use a heat gun to expand the gearcase slightly during installation.*

**STEP 7.** Install the pinion bearing snap ring with its “sharp” edge facing out.

### Inspection

**STEP 1.** Slowly rotate the output shaft by hand, and check for excessive “drag” (preloading).

☛ *Excessive drag can usually be eliminated by sharply tapping the input end of the gearcase with a soft-faced hammer (Figure 11.24).*

**STEP 2.** Prelube and install the gearcase output shaft seal.

### Lubrication

■ Lubricate the gearcase with Shindaiwa Premium Gearcase Lube™, and install the gearcase plug and collar.

### Gearcase Installation

■ Assemble the gearcase to the shaft, and reinstall holders and cutting attachment.

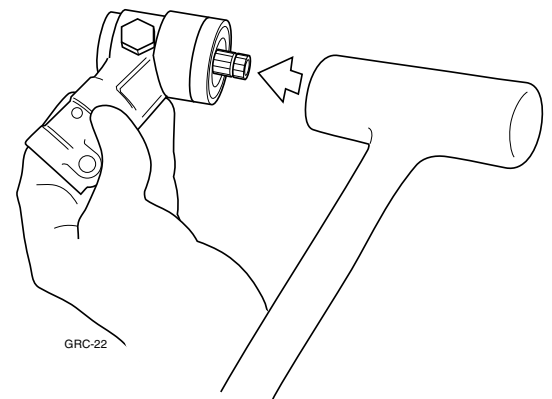


Figure 11.22 Seat the output shaft and gear assembly.

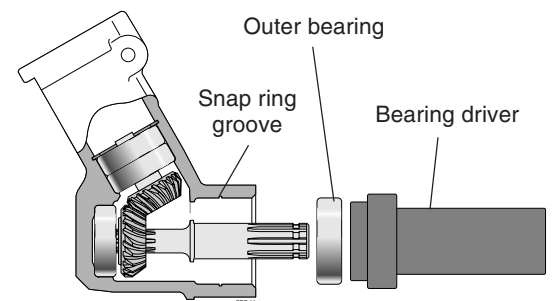


Figure 11.23 Installing the outer bearing.

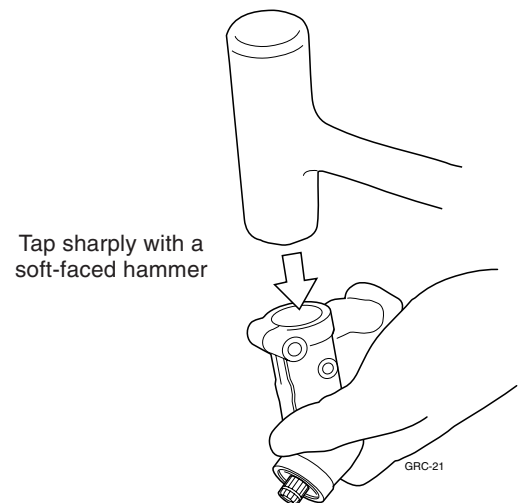


Figure 11.24 Removing excess drag from the 250 gearcase.

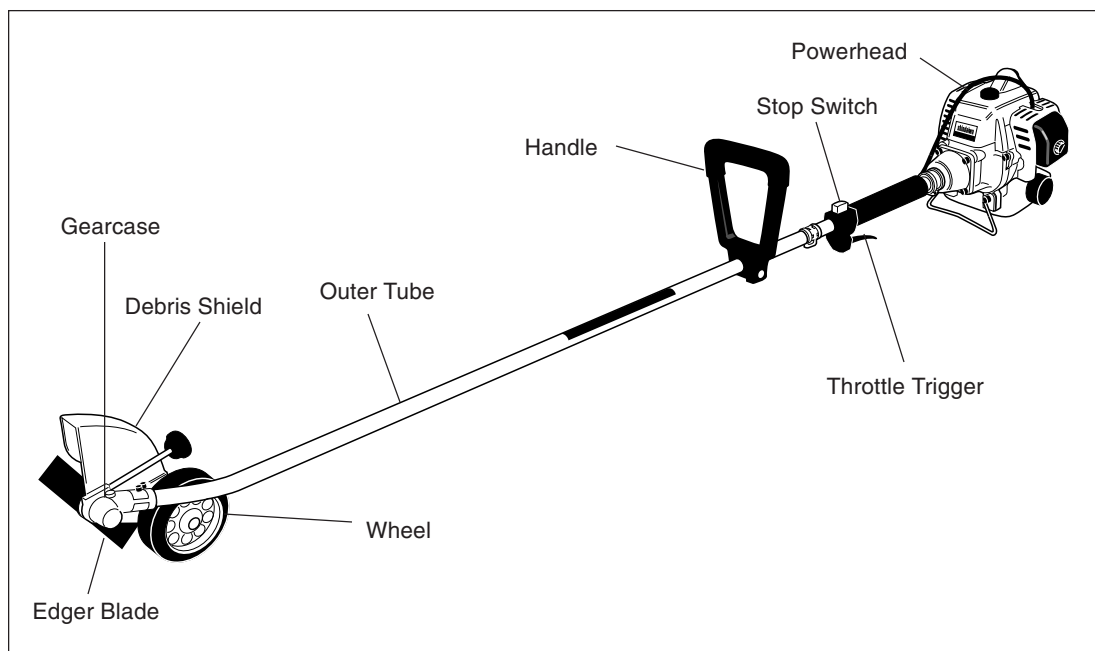


Figure 12.1 Major components of a Shindaiwa LE-series lawn edger (LE-250 shown).

## General

The 230-series and 250-series lawn edgers are based on standard Shindaiwa powerheads.

Both machines turn a solid steel edging blade by means of a flexible cable and gearbox. The LE-series machines offer a powerful and lightweight alternative to edging with string trimmers or bulky three-wheeled machines (Figure 12.1).

## Common Parts (Figure 12.2)

The following parts are interchangeable between the LE-230 and the LE-250 edger:

- The shaft tube, flexible cable, and liner are identical for both units.
- The gearcase, blade, guard, and wheel are all identical for both units.

### IMPORTANT!

The model LE gearcase is not interchangeable with the T/C gearcases installed on Shindaiwa trimmers and brushcutters!

### Unique Parts

The following parts are unique to each model, and are not interchangeable between the LE-230 and LE-250:

- Clutch shoes and drum
- The powerheads are interchangeable between LE units (they require appropriate throttle cable and stop switch), but are not interchangeable with powerheads for trimmers and brushcutters.

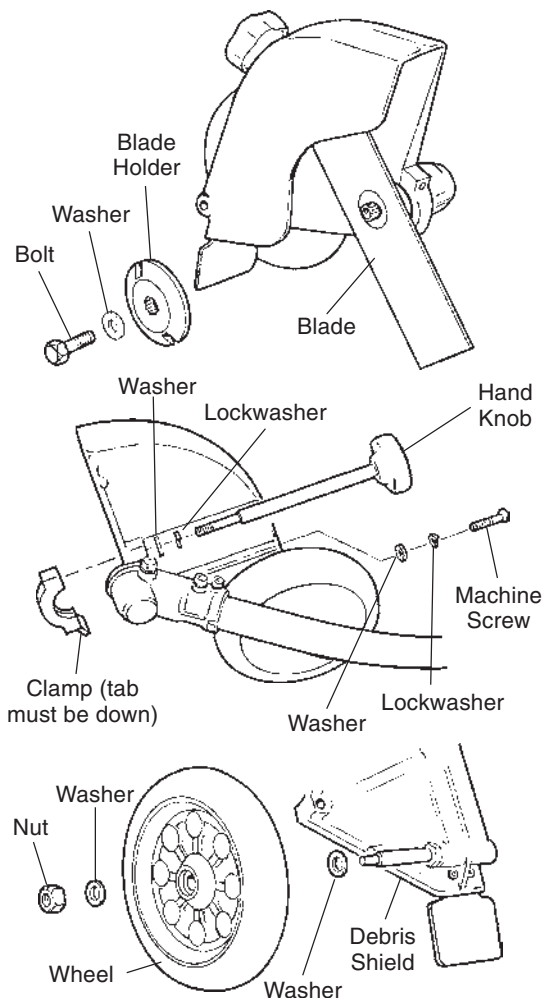


Figure 12.2 Parts unique to Shindaiwa LE-230 and LE-250 lawn edgers.



**NOTE:**

When in doubt as to interchangeability of specific components, consult the appropriate Illustrated Parts List (IPL).

**WARNING!**

Never attempt to modify a Shindaiwa trimmer or brushcutter for use as a blade-equipped edger!

**Notes on Service**

- Service procedures for the powerhead and related component are the same as those for trimmers and brushcutters of the same engine series. Refer to the appropriate sections of this manual.
- Gearcase service for both units is identical to gearcase service for the T/C-250. See Section 11.

**CAUTION!**

Disassembling the gearcase on either the LE-230 or the LE-250 requires removing the output (driven) shaft and gear together as a single component!

- Flexible cable service and repair procedures are similar to the procedures for Shindaiwa flex-shaft trimmers. Refer to Section 10.

**CAUTION!**

Flexible cables for Shindaiwa lawn edgers must be cleaned and re-lubricated at least every 50 hours of operation, or when the unit is returned to service after extended storage! Inadequate cable lubrication can cause rapid wear of the flexible cable and the liner, resulting in increased vibration and greatly reduced service life!



	F-18	T-18	F-20	F-21	T-20	T-230	C-230	LE-230	T-250	C-250	LE-250
ENGINE											
Displacement (cc/cu. in.)	18.4/1.1	18.4/1.1	19.8/1.2	21.1/1.3	21.1/1.3	22.5/1.37	22.5/1.37	22.5/1.37	24.1/1.47	24.1/1.47	24.1/1.47
Bore/stroke	30x26	30x26	30x28	30x28	30x28	32x28	32x28	32x28	32x30	32x30	32x30
Horsepower	.8	.8	1.0	1.1	1.1	1.1	1.1	1.1	1.2	1.2	12
RPM @ maximum hp	8,000	8,000	7,500	7,500	7,500	7,500	7,500	7,500	7,000	7,000	7,000
Maximum no-load RPM	11,000	10,000	11,000	11,000	11,500	10,000	10,000	10,000	11,500	11,500	11,500
Weight (lb./kg)	8.6/3.9	9.4/4.3	10.6/4.8	10.8/4.9	9.75/4.4	9.5/4.3	10.1/4.6	10.1/4.6	11/5.0	11.5/5.2	11.5/5.2
Power/weight (hp/lb.)	7.8	8.5	10.6	9.8	8.9	8.6	9.18	9.18	9.17	9.6	9.6
Specific output (cc per hp)	23	23	19.8	19.2	19.2	20.5	20.5	20.5	20.1	20.1	20.1
Idle RPM ( ± 100)	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Clutch engagmnt. rpm ( ± 250)	3,650	4,150	3,750	3,700	4,250	3,700	3,700	3,000	3,000	3,000	3,000
Crankshaft	3-pc. w/pressed-in crankpin (F-18, T-18, F-20, F-21, T-20)					3-piece	3-piece	3-piece	3-piece	3-piece	3-piece
Crankshaft bearings	Ball bearings (all models)										
Conrod	Forged, 1-piece (all models)										
Conrod bearing—large end	Caged Needle Bearing (all models)										
Conrod thrust control	Small End of Conrod (all models)										
Piston	Forged aluminum (all models)										
Rings	2	2	2	2	2	2	2	2	2	2	2
Cylinder	Chromed, open transfer ports (F-18, T-18, F-20, F-21, T-20)						Chrome plated, Etched (T/C/LE-230 and T/C/LE-250)				
Crankcase pressure test	4 to 6 pounds maximum, no loss over a 3-minute test (all models)										
FUEL SYSTEM											
Carburetor	TK	TK	Walbro	Walbro	TK	Walbro	Walbro	Walbro	TK	TK	TK
Model	DPK8W	DPK8W	WA-135	WY-24B	DPV10W1B	WYL-19	WYL-19	WYL-19	DPN-10W	DPN-10W	DPN-10W
Primer/Air Purge	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjustment: H	1-1/2	1-1/2	1-1/8	*	2 ± 1/4	Replaceable Jet (T/C/LE-230)			2 ± 1/4	2 ± 1/4	2 ± 1/4
Adjustment: L	n/a	n/a	1 1/8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Mounting method	Captive-nut Insulator Block (F-18, T-18, F-20, F-21, T-20)					Insulator Block (T/C/LE-230)			Boot and Insulator Block		
Filtration	Oiled Foam Element (all models)										
Fuel tank location	Under Engine (all models)										
Tank Mounting System	Cushion (all models)										
Number of Elements	4	4	2	4	4						
Tank Capacity (metric/ounces)	500cc/16.8 500cc/16.8 400cc/11.8 510cc/17.2 (F21/T20) 510cc/17.2 .6 liters/20 (T/C/LE-230 and T/C/LE-250)										
Fuel Vent	Duckbill	Duckbill	Screw	Duckbill	Duckbill	Duckbill	Duckbill	Duckbill	Duckbill	Duckbill	Duckbil
Vent location	Remote	Remote	Tank	Remote	Remote	Remote	Remote	Remote	Remote	Remote	Remote
Recommended fuel	Unleaded Regular (all models)										
Fuel/oil ratio*	40:1 (all models)										
	*Failure to use manufacturer's recommended oil ratios could void manufacturer's warranty. See warranty policy for details.										
CLUTCH											
Material	Bonded	Bonded	Bonded	Bonded	Bonded	Bonded, Organic (T/C/LE-230 and T/C/LE-250)					
Number of Shoes	2	2	2	2	2	2	2	2	2	2	2
Number of Springs	2	2	2	2	2	2	2	2	2	2	2
RECOIL											
Housing material	Nylon	Nylon	Diecast	Nylon	Nylon	Glass-filled Nylon (T/C/LE-230 and T/C/LE-250)					
Attachment points	4	4	4	4	4	4	4	4	4	4	4
Cord diameter (mm)	3	3	3		3	3	3	3	3.5	3.5	3.5
Cord length (mm)	759	759	845	845	845	759	759	759	826	826	826

	F-18	T-18	F-20	F-21	T-20	T-230	C-230	LE-230	T-250	C-250	LE-250
IGNITION											
Ignition type	STCI (all models)										
Components	1	1	2	2*	2	1	1	1	1	1	1
Minimum output voltage	18 kV (all models)										
Coil/flywheel air gap	.012-.014"										
Ignition timing	Transistorized advance (all models)										
Spark Plug, Recommended	Champion CJ-8 (all models)										
Spark Plug, Alternative(NGK)	NGK BM6A (all models)										
Spark Plug gap	.025"	.025"	.025"	.025"	.025"	.024"	.024"	.024"	.024"	.024"	.024"
MUFFLER											
Muffler type	1-piece	1-piece	Multi	1-piece	1-piece	Sealed, 1-piece (T/C/LE-230 and T/C/LE-250)					
Attachment points	2	2	2	2	2	3	3	3	3	3	3
ANTI-VIBRATION											
Engine/lower unit	No	Yes	No	No	Yes	Rubber Cushion (T/C/LE-230 and T/C/LE-250)					
Front Handlebar	No (All Models)										
Soft rear handgrip	Yes (All Models)										
Spring/rubber on harness	N/A	No	N/A	No	No	N/A	No	Yes	Yes		
LOWER UNIT											
Drive Type	Shaftcase	Gearcase	Shaftcase	Shaftcase	Gearcase	Gearcase w/4 bearings, spiral-bevel gears (T/C/LE-230, T/C/LE-250)					
Gearcase ratio	1:1	1.286:1	1:1	1:1	1.286:1	1.36:1	1.36:1	1.36:1	1.36:1	1.36:1	1.36:1
Gearcase Paint						None	None	None	None	None	None
Outer Tube: Material	Aluminum	Aluminum	Steel	Aluminum	Aluminum	6061 T-6 Aircraft Alloy Aluminum; Extruded and Drawn					
Diameter	24 mm	24 mm	20 mm	22 mm	24 mm	24 mm	24 mm	24 mm	24 mm	24 mm	24 mm
Wall Thickness	1.6 mm	1.5 mm	1.0 mm	1.6	1.5 mm	1.5 mm	1.5 mm	1.5 mm	1.5 mm	15 mm	15 mm
Overall Length	1245 mm	1450 mm	1372 mm	1572 mm	1500 mm	1450 mm	1450 mm	1500 mm	1500 mm	1500 mm	1500 mm
Shaft Type	Flex	Solid	Flex	Flex	Solid	1-piece; splined		Cable	1-piece; splined		Cable
Shaft/cable diameter	6 mm	6 mm	6 mm	6 mm	6 mm	6 mm	6 mm	6 mm	7 mm	7 mm	6 mm
Shaft/cable length	1262 mm	1495 mm	1393 mm	1588 mm	1545 mm	1495 mm	1495 mm	1540 mm	1545 mm	1545 mm	1540 mm
Number of Bushings	Liner	4	Liner	Liner	4	5	5	Liner	5	5	Liner
CONFIGURATION											
Loop front handle	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
Handlebars	No	No	No	No	No	No	Yes	Yes	No	Yes	Yes
Grip-mounted throttle	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Handlebar throttle	No	No	No	No	No	No	No	No	No	No	No
Grip stop switch	Yes	Yes	No	No	No	Yes**	Yes	Yes	Yes	Yes	Yes
Engine-mtd. stop switch			Yes								
WEIGHTS											
Unit less accessories (lb/kg.)	8.6/3.9	9.4/4.3	10.6/4.8	10.8/4.9	9.75/4.4	9.5/4.3	10.1/4.6	11.9/5.4	11/5.0	11.5/5.2	12.3/5.6

\* Later versions of F-21 trimmers feature a one-piece modular ignition system.

\*\* Later versions of T-20 trimmers feature a grip-mounted stop switch.

	T-25	C-25	T-27	C-27	C-35	BP-35	B-40	B-45	RC-45
ENGINE									
Displacement (cc/cu. in.)	24.1/1.5	24.1/1.5	27.2/1.7	27.2/1.7	33.6/2.1	33.6/2.1	39.4/2.3	41.5/2.6	41.5/2.6
Bore/stroke	32x30	32x30	34x30	34x30	36x33	36x33	39x33	40x33	40x33
Horsepower	1.4	1.4	1.5	1.5	1.8	1.8	2.3	2.33	2.33
RPM @ maximum hp	8,500	8,500	7,500	7,500	7,500	7,500	8,000	8,000	8,000
Maximum no-load RPM	11,500	11,500	11,500	11,500	11,500	11,500	11,500	11,500	11,500
Weight (lb./kg)	12.3/5.6	12.5/5.7	12.3/5.6	12.5/5.7	14.1/6.4	20.5/9.3	16.8/7.6	17.8/8.1	17.9/8.4
Power/weight (hp/lb.)	8.8	8.9	8.2	8.3	7.8	11.4	7.3	7.6	???
Specific output (cc per hp)	17.2	17.2	18.1	18.1	18.7	18.7	17.1	17.8	???
Idle RPM ( ± 100)	3,000	3,000	3,000	3,000	2,750	2,750	2,750	2,750	2,750
Clutch engagement rpm ( ± 250)	4,500	4,500	4,500	4,500	3,800	3,750	3,700	3,800	3,800
Crankshaft	3-piece with pressed-in crankpin (all models)								
Crankshaft bearings	Ball bearings (all models)								
Conrod	Forged, 1-piece (all models)								
Conrod bearing - large end	Caged Needle Bearing (all models)								
Conrod thrust control	Small End of Conrod (all models)								
Piston	Forged aluminum (all models)								
Rings	2	2	2	2	2	2	2	2	2
Cylinder	Chrome-plated; Open transfer Ports (all models)								
Crankcase pressure test	4 to 6 pounds maximum, no loss over a 3-minute test (all models)								
FUEL SYSTEM									
Carburetor	TK	TK	TK	TK	TK	TK	TK	TK	TK
Model	DP10W	DP10W	DPV10W	DPV10W	DPV10W	PC10HW	DPW13	DPW12	DPV 1W 1E
Primer/Air Purge	Primer	Primer	Primer	Primer	Primer	N/A	Primer	Primer	Primer
Adjustment: H	2-1/4	2-1/4	2-1/4	2-1/4	2	N/A	2-3/4	2-1/2—3	2-1/4
Adjustment: L	0-1/2	0-1/2	0-1/2	0-1/2	1/2	N/A	3/4	1/2	1/4
Mounting method	Captive-Nut Insulator Block (all models)								
Filtration	Oiled Foam Element (all models)								
Tank location (relative to engine)	Under	Under	Under	Under	Under	Top	Top	Under	Under
Tank Mounting System	Bungee	Bungee	Cushion	Cushion	Bungee	Bungee	Bungee	Bungee	Bungee
Number of Elements	2	2	3	3	2	2	2	2	2
Tank Capacity (cc/ounces)	700/24	700/24	660/22.7	660/22.7	1,000/34	1,200/40.6	1,100/37.2	1,000/34	1,000/34
Fuel Vent	Duckbill	Duckbill	Duckbill	Duckbill	Duckbill	Duckbill	Duckbill	Duckbill	Duckbill
Vent location	Tank	Tank	Tank	Tank	Tank	Cap	Cap	Tank	Tank
Recommended fuel	Unleaded Regular (all models)								
Fuel/oil ratio*	40:1 (all models)								
	*Failure to use manufacturer's recommended oil ratios could void manufacturer's warranty. See warranty policy for details.								
CLUTCH									
Material	Bonded	Bonded	Bonded	Bonded	Bonded*	Bonded	Metal	Bonded*	Bonded*
Number of Shoes	2	2	2	2	3*	2	4	3	3
Number of Springs	1	1	1	1	3*	2	4	3	3
RECOIL									
Housing material	Diecast	Diecast	Nylon	Nylon	Diecast	Diecast	Diecast	Diecast	Diecast
Attachment points	3	3	4	4	4	4	4	4	4
Cord diameter (mm)	3.5	3.5	3.5	3.5	4	4	4	4	4
Cord length (mm)	806	806	826	826	806	810	810	810	810

\* A C-35 brushcutter may be fitted with a 2-shoe, 3-shoe, or 4-shoe clutch assembly. Refer to Section 6 and Shindaiwa Parts Revision No. PR-115.

	T-25	C-25	T-27	C-27	C-35	BP-35	B-40	B-45	RC-45
IGNITION									
Ignition type	STCI (all models)								
Number of Components	2	2	1	1	2	2	2	2	2
Minimum output voltage	18 kV (all models)								
Coil/flywheel air gap	.012-.014"/.3mm (all models)								
Ignition timing	Transistorized advance								
Spark plug, recommended	Champion CJ-8		Champion CJ-8Y		Chmp. CJ-8	Chmp. CJ-8	Chmp. CJ-8	Chmp. CJ-8	Chmp. CJ-8
Spark plug alternative	NGK BM6A (all models)								
Spark plug gap	.025"/.6mm (all models)								
MUFFLER									
Muffler type	1-piece	1-piece	1-piece	1-piece	1-piece	Sealed, 1-piece, with Spark Arrestor Screen			
Attachment points	3	3	3	3	3	3	3	3	3
ANTI-VIBRATION									
Engine/lower unit	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Front Handlebar	No	No	No	Yes	Yes	No	Yes	Yes	Yes
Soft rear handgrip	Yes	N/A	Yes	N/A	N/A	N/A	N/A	N/A	N/A
Spring/rubber on harness	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes
LOWER UNIT									
Drive Type	Gearcase (all models)								
Gearcase ratio	1.235:1	1.235:1	1.357:1	1.357:1	1.357:1	1.235:1	1.357:1	1.357:1	1.357:1
Outer Tube Material	6061-T6 Aircraft Alloy Aluminum; Extruded and Drawn (all models)								
Diameter	26 mm	26 mm	26 mm	26mm	28 mm	26 mm	28 mm	28 mm	28 mm
Wall Thickness	1.5 mm	1.5 mm	1.6 mm	1.6 mm	2.0 mm	1.5 mm	2.0 mm	2.0 mm	2.0 mm
Overall Length	1500 mm	1500 mm	1,00 mm	1500 mm	1400 mm	1318 mm	1400 mm	1400 mm	1400 mm
Shaft Type	Splined, solid 1-piece Mainshaft					Splined, 1-piece		Splined, 1-piece, Hollow	
Shaft/cable diameter	7 mm	7 mm	7 mm	7 mm	8 mm	7/10 mm?	8 mm	10 mm	10 mm
Shaft/cable length	1547 mm	1547 mm	1547 mm	1547 mm	1452 mm	1402 mm	1451 mm	1451 mm	1451 mm
Number of Bushings	5	5	5	5	5	4	5	5	5
CONFIGURATION									
Loop front handle	Yes	No	Yes	No	No	Yes	No	No	No
Handlebars	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes
Grip-mounted throttle	Yes*	No	Yes	No	No	Yes	No	No	No
Handlebar throttle	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes
Grip stop switch	Yes*	No	Yes	Yes	No	Tube	No	No	Grip
Engine-mtd. stop switch		Tube			Yes		Yes	Yes	
WEIGHT									
Unit less accessories (lb/kg)	12.3/5.6	12.5/5.7	12.3/5.6	12.5/5.7	14.1/6.4	20.5/9.3	16.8/7.6	17.8/8.1	

# Section 13 Appendix Torque Values

	Bolt/ Screw	Values given in inch/pounds (Kgcm)				
Location	Size	F/T-18	F-20	T-20	T/C-230	T/C-250
<b>ENGINE</b>						
Crankcase	5 mm	44-60 (50-70)—all models				
Cylinder to Crankcase	5 mm	44-60 (50-70)—all models				
Cylinder to Carburetor Insulator	5 mm	35-44 (40-50)*	35-44 (40-50)*	35-44 (40-50)*	35-44 (40-50)*	44-52 (50-60)*
Flywheel	8 mm	104-122 (120-140)-all models				
	10 mm					
Starter Hub (on crankshaft)	8 mm	104-122 (120-140)*—all models				
Muffler	5 mm	52-70 (60-80)**	44-60 (50-70)**	44-60 (50-70)**	44-60 (50-70)**	52-70 (60-80)*
	6 mm					
Spark Plug	14 mm	148-165 (170-190)—all models				
Clutch Shoe Bolt	6 mm	60-90 70-100)				
Coil	4 mm	35-44 (40-50)*				
Unit	4 mm	17-26 (20-30)				26-35 (30-40)*
Cylinder Cover & Recoil Starter	4 mm	13-22 (15-25)*				26-35 (30-40)*
	5 mm					
Carburetor	5 mm	35-44 (40-50)—all models				
<b>TRIMMER/BRUSHCUTTER ASSEMBLY</b>						
Gearcase to Outer Tube	5 mm	52-60 (60-70)				
	6 mm					52-78 (60-90)
Handle Bracket	5 mm	52-60 (60-70)				
	6 mm	87-104 (100-120)				
Clamp-Outer Tube	5 mm	35-44 (40-50)	52-60 (60-70)			
Blade Holder	7 mm	87-104 (100-120)				
	8 mm					
	10 mm	104-120 (120-140)				
Trimmer Head	7 mm					
	8 mm	52-87 (60-100)				
Fan Cover	5 mm					

\*Screw Locking Agent Recommended Three Bond #1401

\*\*Screw Locking Agent Recommended Three Bond #1360

# Appendix Torque Values Section 13

	Bolt/ Screw	Values given in inch/pounds (Kg/cm)			
Location	Size	T/C-25	T/C-27	C-35/BP-35/B-40	B-45/RC-45
<b>ENGINE</b>					
Crankcase	5 mm	44-60 (50-70)	44-60 (50-70)	60-70 (70-80)	60-70 (70-80)*
Cylinder to Crankcase	5 mm	44-60 (50-70)	44-60 (50-70)	60-70 (70-80)	60-70 (70-80)
Cylinder to Carb. Insulator	5 mm	44-52 (50-60)*	44-52 (50-60)*	35-44 (40-50)*	44-52 (50-60)*
Flywheel	8 mm	104-122 (120-140)	104-122 (120-140)	175-218 (200-250)	175-218 (200-250)
	10 mm				
Starter Hub on Crankshaft	8 mm	104-122 (120-140)*	104-122 (120-140)*	105-120 (120-140)	105-120 (120-140)
Muffler	5 mm	52-70 (60-80)*	52-70 (60-80)*		
	6 mm			80-90 (90-100)**	90-105 (100-120)**
Spark Plug	14 mm	148-165 (170-190)—all models			
Clutch Shoe Bolt	6 mm	60-90 (70-100)—all models			
Coil	4 mm	35-44 (40-50)*	35-44 (40-50)*	44-52 (50-60)*	44-52 (50-60)*
Unit	4 mm			17-26 (20-30)	17-26 (20-30)
Cylinder Cover & Recoil Starter	4 mm			26-44 (30-50)	26-44 (30-50)
	5 mm	26-35 (30-40)*	26-35 (30-40)*		
Carburetor	5 mm	35-44 (40-50)			
<b>TRIMMER/BRUSHCUTTER ASSEMBLY</b>					
Gearcase to Outer Tube	5 mm				
	6 mm	52-78 (60-90)	52-78 (60-90)	90-105 (100-120)	90-105 (100-120)
Handle Bracket	5 mm	52-60 (60-70)—all models			
	6 mm	87-104 (100-120)—all models			
Clamp-Outer Tube	5 mm	52-60 (60-70)—all models			
Blade Holder	7 mm				
	8 mm	104-120 (120-140)			
	10 mm			175-190 (200-220)	175-190 (200-220)
Trimmer Head	7 mm				
	8 mm				
Fan Cover	5 mm				44-60 (50-70)

\*Screw Locking Agent Recommended Three Bond #1401

\*\*Screw Locking Agent Recommended Three Bond #1360

Section 13 Appendix Torque Values

	Bolt/ Screw	Values given in inch/pounds (KgfcM)				
Location	Size	F/T-18	F-20	T-20	T/C-230	T/C-250
<b>ENGINE</b>						
Crankcase	5 mm	44-60 (50-70)–all models				
Cylinder to Crankcase	5 mm	44-60 (50-70)–all models				
Cylinder to Carburetor Insulator	5 mm	35-44 (40-50)*	35-44 (40-50)*	35-44 (40-50)*	35-44 (40-50)*	44-52 (50-60)*
Flywheel	8 mm	104-122 (120-140)-all models				
	10 mm					
Starter Hub (on crankshaft)	8 mm	104-122 (120-140)*–all models				
Muffler	5 mm	52-70 (60-80)**	44-60 (50-70)**	44-60 (50-70)**	44-60 (50-70)**	52-70 (60-80)*
	6 mm					
Spark Plug	14 mm	148-165 (170-190)–all models				
Clutch Shoe Bolt	6 mm	60-90 70-100)				
Coil	4 mm	35-44 (40-50)*				
Unit	4 mm		17-26 (20-30)			26-35 (30-40)*
Cylinder Cover & Recoil Starter	4 mm	13-22 (15-25)*				26-35 (30-40)*
	5 mm					
Carburetor	5 mm	35-44 (40-50)–all models				
<b>TRIMMER/BRUSHCUTTER ASSEMBLY</b>						
Gearcase to Outer Tube	5 mm	52-60 (60-70)				
	6 mm	52-78 (60-90)				
Handle Bracket	5 mm	52-60 (60-70)				
	6 mm	87-104 (100-120)				
Clamp-Outer Tube	5 mm	35-44 (40-50)	52-60 (60-70)			
Blade Holder	7 mm	87-104 (100-120)				
	8 mm	104-120 (120-140)				
	10 mm					
Trimmer Head	7 mm					
	8 mm	52-87 (60-100)				
Fan Cover	5 mm					

\*Screw Locking Agent Recommended Three Bond #1401  
\*\*Screw Locking Agent Recommended Three Bond #1360

	Bolt/ Screw	Values given in inch/pounds (Kgfcmm)			
Location	Size	T/C-25	T/C-27	C-35/BP-35/B-40	B-45/RC-45
<b>ENGINE</b>					
Crankcase	5 mm	44-60 (50-70)	44-60 (50-70)	60-70 (70-80)	60-70 (70-80)*
Cylinder to Crankcase	5 mm	44-60 (50-70)	44-60 (50-70)	60-70 (70-80)	60-70 (70-80)
Cylinder to Carb. Insulator	5 mm	44-52 (50-60)*	44-52 (50-60)*	35-44 (40-50)*	44-52 (50-60)*
Flywheel	8 mm	104-122 (120-140)	104-122 (120-140)	175-218 (200-250)	175-218 (200-250)
	10 mm				
Starter Hub on Crankshaft	8 mm	104-122 (120-140)*	104-122 (120-140)*	105-120 (120-140)	105-120 (120-140)
Muffler	5 mm	52-70 (60-80)*	52-70 (60-80)*		
	6 mm			80-90 (90-100)**	90-105 (100-120)**
Spark Plug	14 mm	148-165 (170-190)—all models			
Clutch Shoe Bolt	6 mm	60-90 (70-100)—all models			
Coil	4 mm	35-44 (40-50)*	35-44 (40-50)*	44-52 (50-60)*	44-52 (50-60)*
Unit	4 mm			17-26 (20-30)	17-26 (20-30)
Cylinder Cover & Recoil Starter	4 mm			26-44 (30-50)	26-44 (30-50)
	5 mm	26-35 (30-40)*	26-35 (30-40)*		
Carburetor	5 mm	35-44 (40-50)			
<b>TRIMMER/BRUSHCUTTER ASSEMBLY</b>					
Gearcase to Outer Tube	5 mm				
	6 mm	52-78 (60-90)	52-78 (60-90)	90-105 (100-120)	90-105 (100-120)
Handle Bracket	5 mm	52-60 (60-70)—all models			
	6 mm	87-104 (100-120)—all models			
Clamp-Outer Tube	5 mm	52-60 (60-70)—all models			
Blade Holder	7 mm				
	8 mm	104-120 (120-140)			
	10 mm			175-190 (200-220)	175-190 (200-220)
Trimmer Head	7 mm				
	8 mm				
Fan Cover	5 mm				44-60 (50-70)

\*Screw Locking Agent Recommended Three Bond #1401

\*\*Screw Locking Agent Recommended Three Bond #1360



## Gasoline

What you need to know about today's motor fuels...



### CAUTION!

Under certain conditions, so-called "oxygenated" motor fuels can raise engine combustion chamber temperatures beyond acceptable limits, and can lead to catastrophic engine failure!

### Oxygenated Fuel

Under the provisions of the Federal Clean Air act of 1990, gasoline sold in thirty-nine U.S. cities and metropolitan areas is now blended with an oxygen-bearing compound on at least a seasonal basis.

The most common oxygenates in use contain either alcohol or an ether additive. Since both alcohol and ether contain oxygen, an engine burning either compound has a hotter rate of combustion and therefore fewer exhaust emissions.

Some states require that the use of oxygenates be posted at the pump. Ethanol alcohol is a commonly used oxygenate, and may contain as much 35% oxygen. Ether-based compounds contain about 18% oxygen and are often marketed as MTBE, TAME, or ETBE.

### IMPORTANT!

Ether-based compounds contain approximately one half the oxygen contained in ethanol, and are usually less damaging to a two-cycle engine!

### Octane Rating

Igniting a fuel within a cylinder causes a rapid expansion of burning gasses. This expansion is what forces the piston to move down the cylinder to transfer energy to the crankshaft.

However, fuel with a low octane rating can ignite violently (detonate) in a high compression engine and may produce cylinder pressures 2 to 3 times higher than normal engine design limitations. Such pressures have a "hammering" effect on pistons and bearings, and can shorten an engine's performance life significantly.

Higher octane fuels are designed to burn longer, producing a steady and controlled increase in combustion chamber pressures.

For maximum performance and engine life, Shindaiwa engines require a fuel with an octane rating of at least 87.

### IMPORTANT!

Ethanol will increase fuel octane rating by 2 to 3 points and is often blended with gasoline as an octane enhancer or "booster".

### Volatility

For easy starting and maximum engine performance, gasoline must remain in a liquid state only until it enters the carburetor venturi.

Gasoline evaporates more rapidly in a warm climate than in a cool climate, and *high-volatile* gasoline will cause performance problems if it vaporizes in the engine's fuel lines or carburetor.

The opposite is true in cool weather. A *low-volatile* fuel can "puddle" in the combustion chamber and cause an engine to be hard to start.

### IMPORTANT!

Gasoline is blended seasonally! Non-seasonal gasoline can cause hard starting due to either vapor-lock or puddling! Always purchase gasoline from a high-volume dealer!

### Alcohol and Water

Condensation can produce water droplets on the inner walls of fuel tanks and other storage containers. These droplets can be readily absorbed by any alcohol in the fuel.

If the alcohol involved has been blended with gasoline, this new alcohol-water mixture is prone to *phase separate* and form a separate and highly corrosive layer at the bottom of the fuel tank.

If this layer is drawn in through an engine's fuel filter, the engine will burn a highly oxygenated fuel mixture with little or no lubricating oil!

### IMPORTANT!

Alcohol blended with gasoline can absorb water, and may phase separate to form a water-alcohol mixture that can shorten engine life dramatically!

## Storage

Gasoline is a complex blend of many different compounds, some of which may degrade during storage.

Old or “stale” gasoline in an engine’s fuel system can attack or deteriorate fuel lines, carburetor diaphragms, and related fuel system components.

If a trimmer or brushcutter must be stored longer than **30 days**, Shindaiwa recommends either:

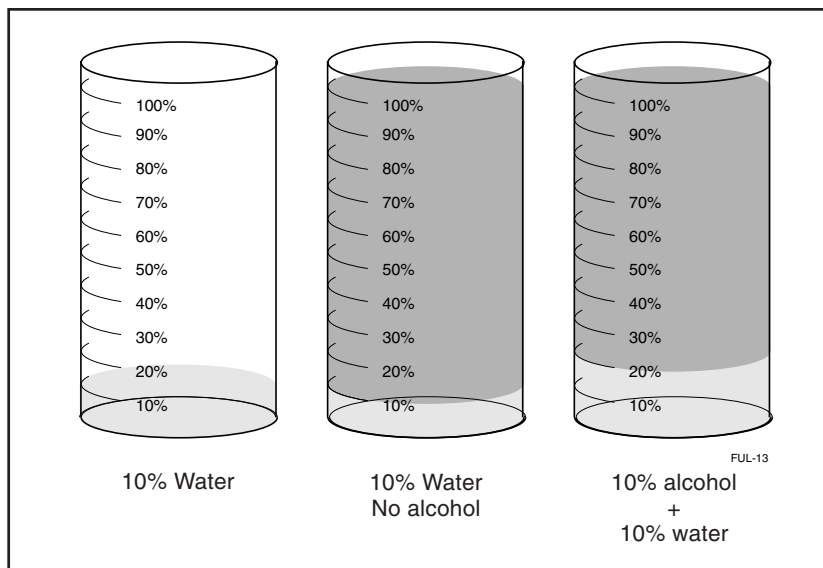
- all unused fuel be removed from the fuel system by draining the fuel tank then running the unit until it stops from fuel starvation.
- or
- pre-treating all fuel supplies with a fuel stabilizer such as StaBil™ (follow the manufacturer’s directions).

### IMPORTANT!

Gasoline octane and volatility can degrade rapidly during storage! If gasoline is to be stored for a period longer than 30-days, Shindaiwa recommends the use of a high-quality fuel stabilizer such as StaBil™ or similar product!

### IMPORTANT!

Some gasoline compounds may deteriorate certain fuel system components! Before storing any trimmer or brushcutter, always drain the fuel tank and then operate the engine until all remaining fuel is drained from the carburetor and fuel lines!



Shaker Test

## Recommendations

When using oxygenated fuels:

- **Never** use any fuel containing more than 10% alcohol by volume. See the sidebar, “Shaker Test.”
- When an oxygenated fuel **must** be used, choose an ether-based oxygenate over one containing alcohol.
- To minimize the risk of lean seizure when using oxygenated fuels, Shindaiwa recommends enriching carburetor fuel settings at least 5%.
- Use only fuels with an octane rating of 87 or higher, and purchase only seasonally blended fuels from a high-volume dealer.
- **Never** store a trimmer or brushcutter with fuel remaining in the carburetor or fuel lines. Pre-treat all stored fuels with an appropriate fuel stabilizer such as StaBil™.
- Always use Shindaiwa Premium 2-Cycle Engine Oil mixed at a fuel/oil ratio of 40:1 (3.2 ozs./U.S. gallon). If Shindaiwa-brand engine oil is not available, fuel should be mixed with a premium grade 2-cycle oil specifically designed for air-cooled engines.

### IMPORTANT!

Under certain conditions, oxygenated fuel can cause an engine to operate “lean”! If a two-cycle engine **must** be operated with oxygenated fuel, the engine’s high-speed adjustment should be enriched at least 5%!

### IMPORTANT!

If you suspect fuel-related engine damage, refer to *Engine Seizure* in the Troubleshooting Section.

### IMPORTANT!

The bright stocks used in two-cycle mixing oils tend to lower overall fuel octane ratings. Whenever possible, use only Shindaiwa Premium 2-Cycle Engine Oil blended at a ratio of 40:1.

Section

13 Appendix Metric Conversions

Length	1 in. = 25.4 mm 1 in. = 2.54 cm 1 ft. = 30.48 cm 1 ft. = .304 meter 1 mile = 1.609 km	1 mm = .03937 in. 1 cm = .3937 in. 1 cm = .0328 ft. 1 meter = 3.28 ft. 1 km = .621 mile
Volume	1 cu. in. = 16.39 cc 1 cu. in. = .061 liter 1 fl. oz. = 29.574 ml 1 fl. oz. = .02957 liter 1 gal. = 3.785 liter	1 cc = .061 cu. in. 1 liter = 61.02 cu. in. 1 ml = .0338 fl. oz. 1 liter = 33.81 fl. oz. 1 liter = .264 gal.
Weight	1 oz. = 28.35 gm 1 lb. = .4536 kg	1 gm = .0353 oz. 1 kg = 2.2 lb.
Force	1 in. lb. = 1.152 kg/cm 1 in. lb. = .112 n/m 1 ft. lb. = .138 kg/m 1 ft. lb. = 1.36 n/m	1 kg/cm = .868 in. lb. 1 n/m = 8.844 lb. 1 kg/m = 7.23 ft. lb. 1 n/m = .737 ft. lb.
Power	1 hp (SAE) = .746 kw 1 hp (SAE) = .9861 hp (DIN) 1 hp (SAE) = 1.017 psi	1 kw = 1.34 hp (SAE) 1 hp (DIN) = 1.104 hp (SAE) 1 psi = .9836 hp (SAE)
Pressure	1 psi = .0689 bar 1 psi = 6.89 kpa 1 psi = .07031 kg/sq cm	1 bar = 14.5 psi 1 kpa = .145 psi 1 kg/sq cm = 14.22 psi
Temperature	°F to °C = Temperature in F - 32 x 5/9 (.555)	°C to °F = Temperature in C x 9/5 (1.8) + 32
Miscellaneous	1 mph = 1.6 km/hr 1 mpg = .425 km/liter	1 km/hr = .625 mph 1 km/liter = 2.35 mpg

## Engine Tools

### Flywheel Puller Assembly

20000-96104

### Piston Pin Puller Assembly (all models)

20021-96601 Assembly

Included with assembly:

- 20000-96631 Guide pin
- 20035-96630 Guide pin
- 20021-96630 Guide pin
- 20021-96650 Pin adapter
- 20021-96660 Pin adapter
- 20021-96670 Pin adapter

### Flywheel Holder

20000-96411

## Outer Tube/ Gearcase Tools

### Bushing Driver (All models)

22000-96101

### T-18/T-20/T/C-230

- 22035-96500 Puller
- 22035-96600 Puller
- 22035-96210 Driver
- 22035-96310 Driver
- 22035-96410 Driver

\*For T/C-250, use 22000-96521 puller bolt with 22035-96510 holder.

### T/C-25, T/C-27

- 22000-96510 Puller
- 22000-96600 Puller
- 22000-96210 Driver
- 22000-96310 Driver
- 22000-96410 Driver

### C-35/B-40/B-45/RC-45

- 22015-96510 Holder
- 22015-96520 Bolt
- 22015-96600 Puller Assembly
- 22015-96210 Driver
- 22015-96310 Driver
- 22015-96410 Driver

## Miscellaneous Tools

### ■ Walbro Pressure Test Gauge

Walbro p/n 57-11

Shindaiwa p/n 99909-93

### ■ Walbro Carburetor Service Kit

Walbro p/n 500-500

### ■ Walbro Metering Lever Height Gauge

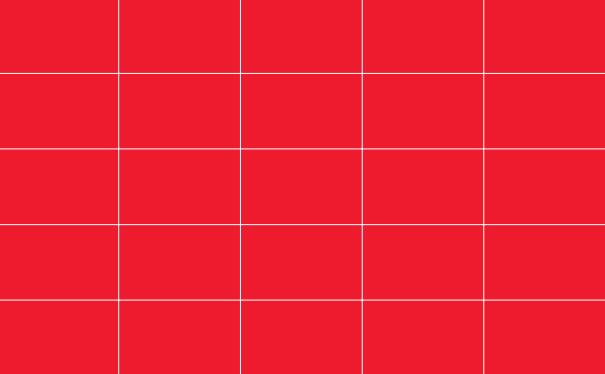
Walbro p/n 500-13

### ■ Cylinder Block Pressure Test Kit

(includes block-off plates and gauge)

Shindaiwa p/n 72174-99200





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